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ENGINEERING NEWS-RECORD

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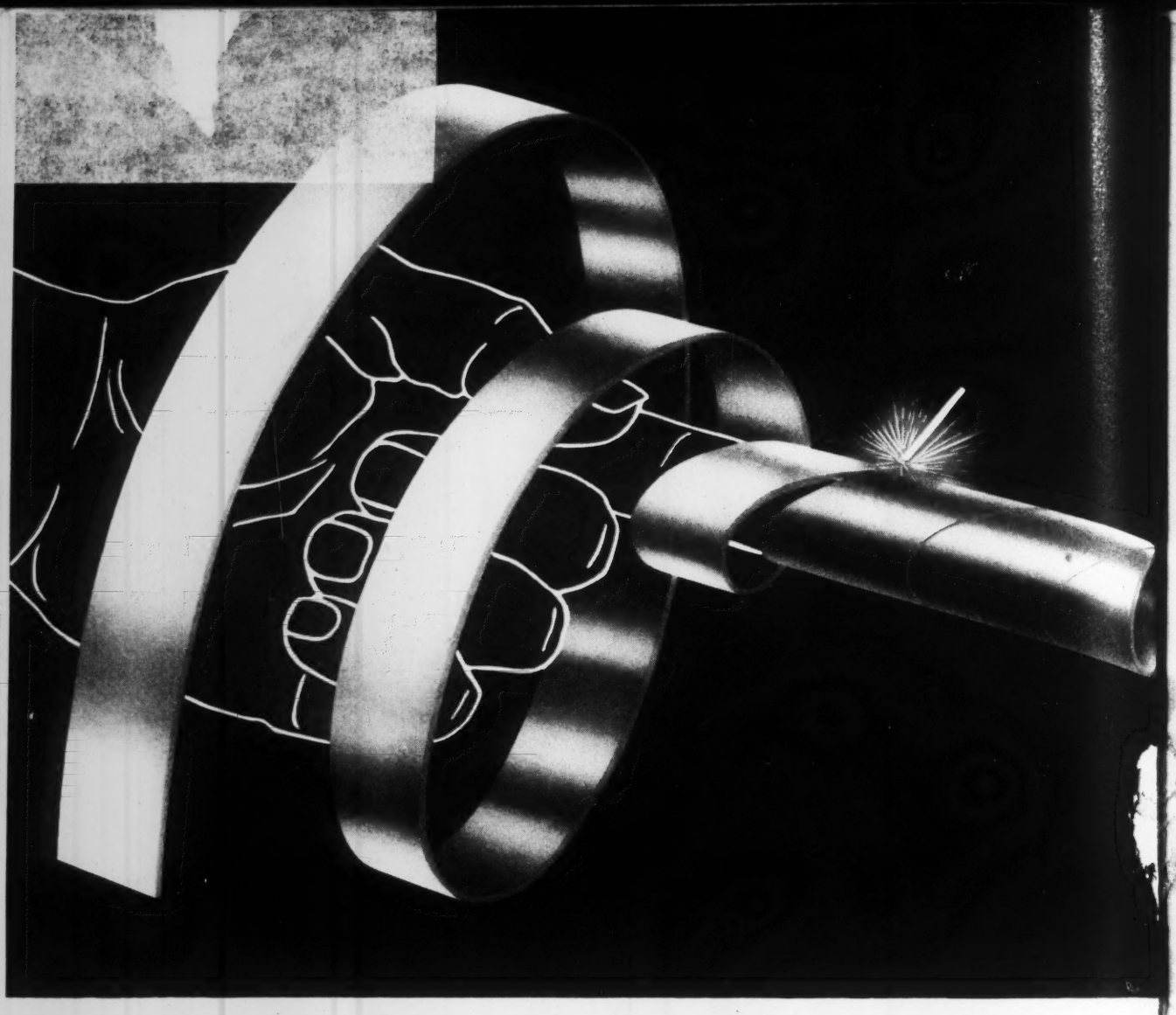
NOVEMBER 13, 1947

Laboratory and 300-ft. microwave tower inclosed with aluminum-faced panels

A SPECIAL SECTION POINTING

TOWARD LOW-COST BUILDING



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A flat ribbon of steel slips into an automatic machine. A twist, a weld, and it emerges as ARMCO Steel Pipe—one of the world's finest pipes for water and gas lines, process piping, foundation piling, dredge pipe, and many other uses.

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Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Industrial Plants, Transportation, Harbors

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NOVEMBER 13, 1947

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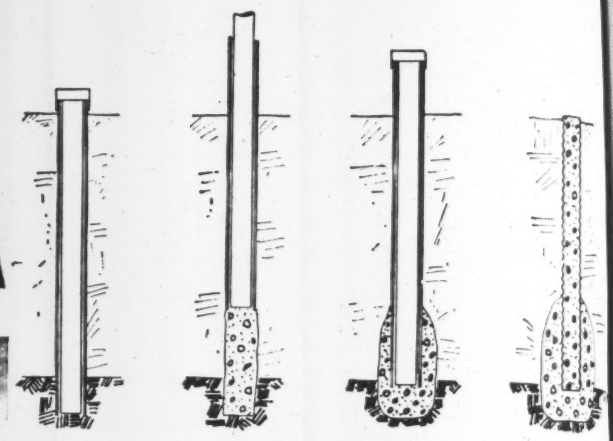

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WESTERN'S PEDESTAL PILES HAVE NEVER FAILED!

The Pedestal Pile provides great carrying capacity because when a firm bearing stratum is reached, a concrete bulb is formed. The bulb increases the bearing area and the resultant distribution of the load adds greatly to the carrying capacity of the pile.

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W

Construction Trends

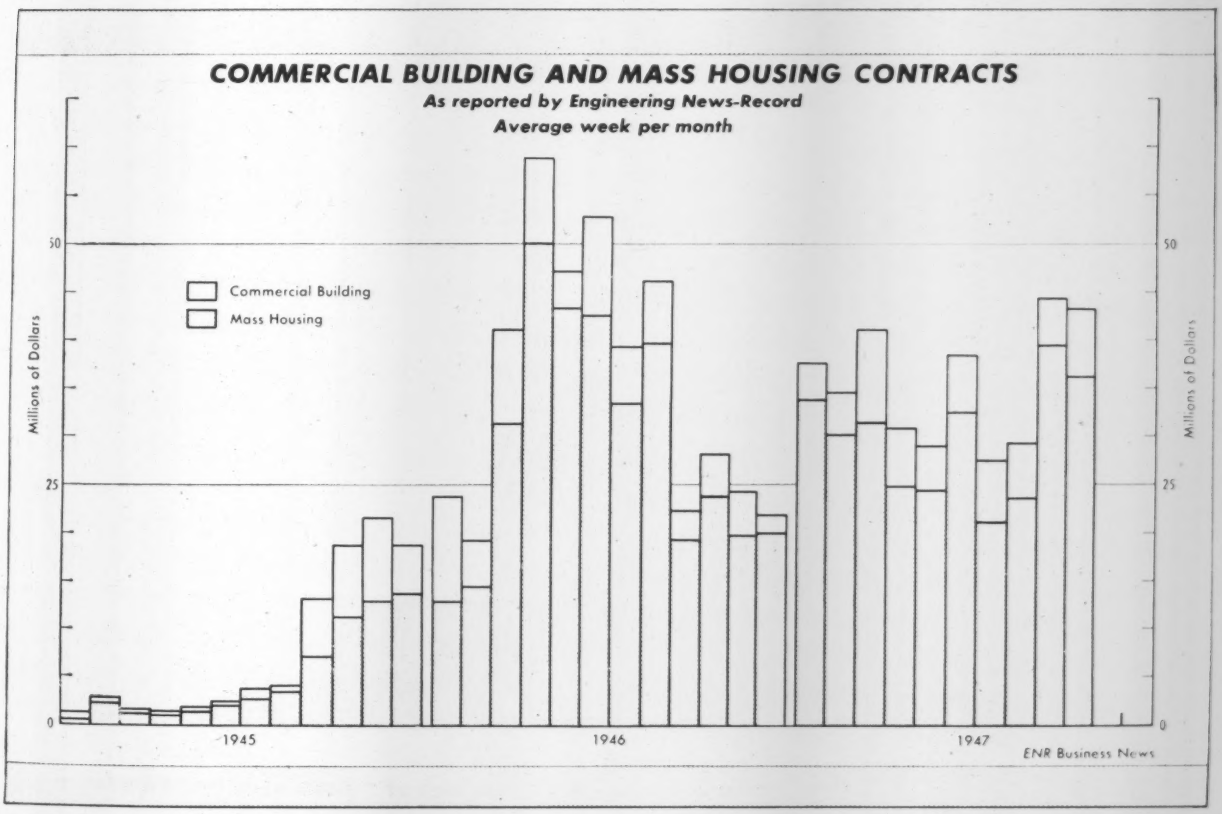
Housing Boom Continues Through October

The weekly average of mass housing contracts awarded during October amounts to $36,000,000, or the second highest weekly average so far this year. The October average was exceeded only in September when the average contract volume reached $39,400,000. As compared with a year ago, both the September and October averages showed substantial gains, rising 104 and 51 percent, respectively, over the corresponding months of 1946.

The cumulative total of mass housing contracts awarded during the first ten months of 1947, however, is running 4 percent below a year ago. As reported by *Engineering News-Record*, total mass housing contract volume from January through October of this year amounts to $1,305,400,000 as compared with the corresponding 1946 total of $1,360,400,000. Commercial building contracts, other than housing, showed a 16 percent drop during this period, declining to $254,000,000 at the end of October, 1947 from $300,300,000 in the comparable period of 1946.

As compared with the last war year of 1945, the volume of mass housing in the first ten months of 1947 is over seven and a half times the corresponding 1945 volume. Commercial building contracts, other than housing, are three times greater than the volume recorded in 1945.

Of the total volume of commercial building contracts, amounting to $1,559,400,000 so far this year, 84 percent were housing contracts, while the remaining 16 percent went for such building projects as hospitals, clubs, banks, offices, theaters, stores, private schools and colleges, and churches. In the first ten months of 1946, 82 percent of the total contract awards of $1,661,200,000 went for housing and 18 percent for other commercial building projects.



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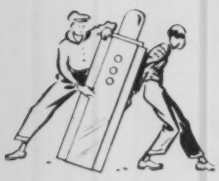
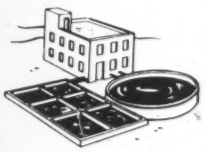
From start to finish in any job involving chlorination — whether it's drinking water sterilization, sewage treatment, swimming pool disinfection or process or cooling water treatment — you'll be on the right track to practical answers to your problems when you rely on the skill behind the W & T shield.

In DESIGN you'll find W & T Engineers willing and helpful. They can draw from more than thirty years' experience in making practical recommendations.

In BUYING you'll find W & T Equipment right for the job — large or small — industrial or municipal.

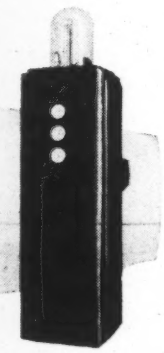
When it's time to INSTALL you'll find both W & T Engineers and Equipment on the job at the right time to give your client a workable installation fully meeting the requirements.





And, finally, LIVING with the job you'll find W & T's Service Organization always on call to ensure dependable, uninterrupted chlorination.

"THE ONLY SAFE WATER IS A STERILIZED WATER"



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S-15

New Construction Volume in October

Civil engineering construction volume in continental United States totals $575,089,000 for October, an average of $115,018,000 for each of the five weeks of the month. This average is 7 percent below the average for September, but 18 percent above the average for October, 1946, according to *Engineering News-Record*.

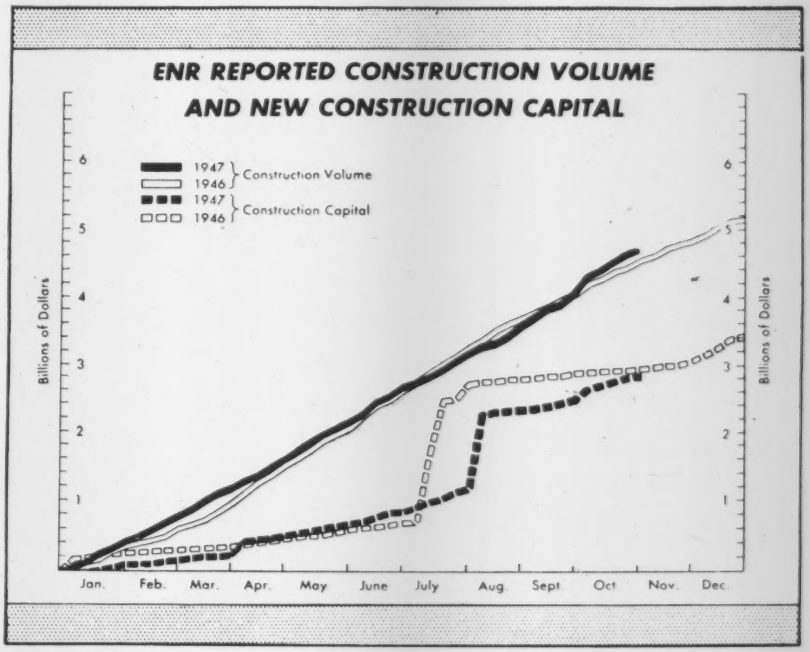
Private construction for October on a weekly average basis is 7 percent below last month, but 20 percent above October, 1946. Public construction is 7 percent below last month, but 14 percent above last October. State and municipal construction is 1 percent above last month, and 9 percent above the average for October, 1946. Federal construction, down 39 percent from last month, is 60 percent above October, 1946.

Weekly averages in the various classes of construction for October, 1947 compared with September, 1947 show gains in public bridges, of 42 percent; public buildings, 30 percent; and waterworks, 10 percent. Losses are recorded for commercial buildings, of 3 percent; highways, 8 percent; industrial buildings, 11 percent; private unclassified, 19 percent; sewerage, 30 percent; public unclassified, 37 percent; and earthwork and drainage, 55 percent.

Geographically, two sections showed gains in October, 1947 over September—Middle Atlantic, 19 percent; and South, 10 percent. Far West dropped 6 percent; Middle West, 9 percent; West of the Mississippi, 27 percent, and New England, 41 percent.

Four sections made gains in October over October, 1946—Middle Atlantic, 45 percent; West of the Mississippi, 30 percent; Far West, 14 percent; and Middle West, 13 percent. South dropped 10 percent below last year; and New England, 27 percent.

New capital for construction for the five weeks of October, 1947 totals $325,628,000, or a weekly average of $65,126,000 for the month. The weekly average is 73 percent above the weekly average of $37,645,000 for September, 1947 and 186 percent above the weekly average of $22,792,000 for October, 1946.

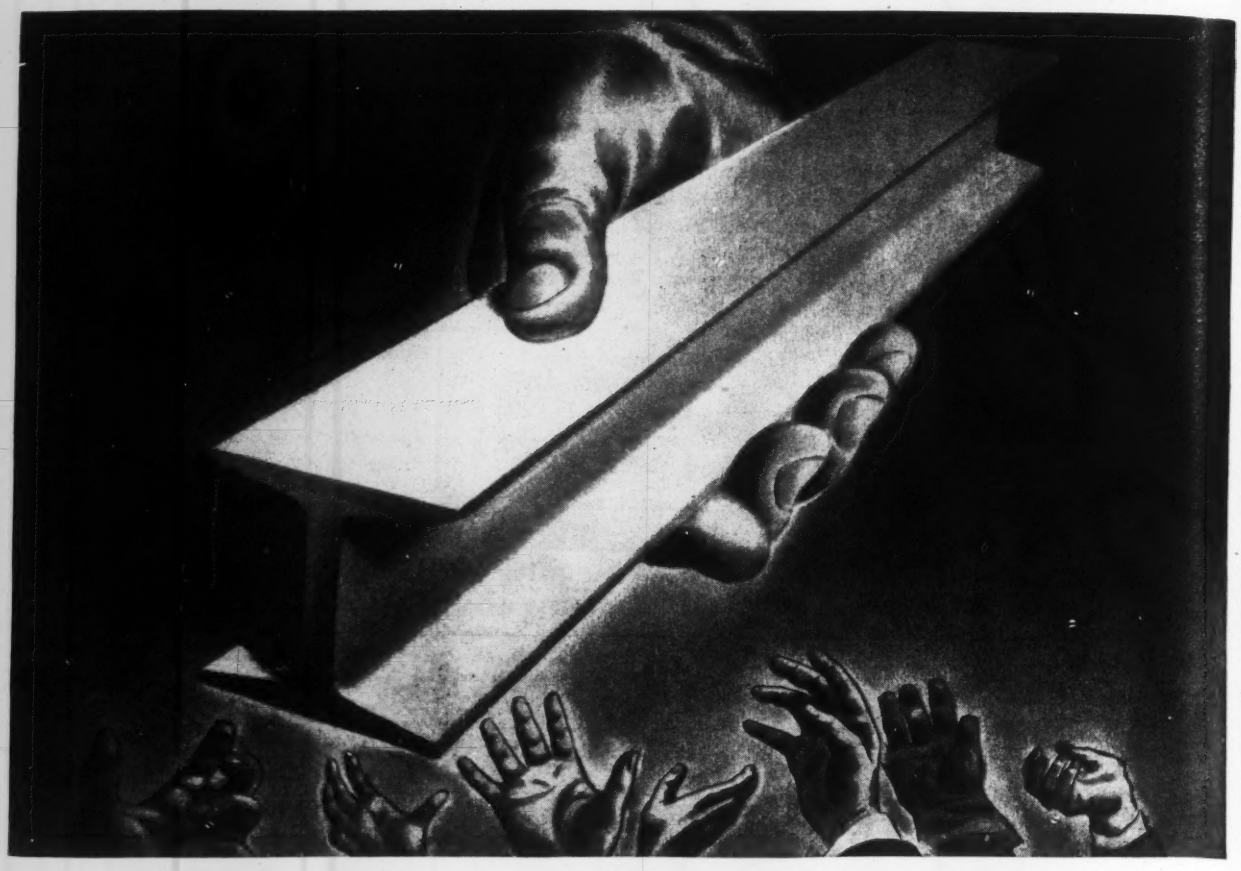


ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD — OCTOBER, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States October 1947	United States Ten Months 1947	United States Ten Months 1946	Canada
Public Works										
Waterworks	99	789	3,051	1,184	4,847	1,268	11,238	93,412	95,558	800
Sewerage	145	556	539	3,125	4,473	2,923	11,761	115,724	96,483	546
Bridges, public	548	4,261	7,901	4,822	8,238	3,553	29,323	160,863	113,107	.....
Earthwork and waterways	61	694	2,928	4,380	8,404	1,971	18,438	249,642	319,902	896
Streets and roads	1,729	14,321	15,734	13,377	21,993	8,158	75,312	685,039	681,026	1,279
Buildings, public	2,757	15,742	10,045	9,123	10,456	16,704	64,827	494,912	342,683	12,530
Unclassified, public	111	4,056	1,455	1,632	1,885	4,315	13,454	210,850	146,224	1,960
Total public	**5,450**	**40,419**	**41,653**	**37,643**	**60,296**	**38,892**	**224,353**	**2,010,442**	**1,794,982**	**18,011**
Federal government (included in above classifications)	447	2,641	5,256	4,851	9,278	8,290	30,763	523,877	558,328	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	824	2,092	.....
Industrial buildings	3,141	27,115	5,752	26,121	29,348	9,443	100,920	752,461	940,313	18,268
Commercial buildings	10,020	107,876	43,847	8,005	28,925	17,025	215,698	1,559,397	1,661,240	4,945
Unclassified, private	372	550	1,503	977	30,151	565	34,118	358,367	172,991	3,150
Total private	**13,533**	**135,541**	**51,102**	**35,103**	**88,424**	**27,033**	**350,736**	**2,671,049**	**2,776,636**	**26,363**
Total Engineering Construction:										
October, 1947 — 5 weeks	**18,983**	**175,960**	**92,755**	**72,746**	**148,720**	**65,925**	**575,089**	.....	.....	**44,374**
September, 1947 — 4 weeks	25,842	118,726	67,223	63,714	163,221	56,079	494,805	.....	.....	38,730
October, 1946 — 5 weeks	26,091	121,508	103,573	64,473	114,750	58,062	488,457	.....	.....	23,177
Ten Months — 1947	**178,996**	**1,228,955**	**797,575**	**632,722**	**1,119,648**	**723,595**	.....	**4,681,491**	.....	**382,222**
Ten Months — 1946	270,292	1,079,507	718,916	552,789	932,961	1,017,153	.....	.....	4,571,618	272,423



Brother, can you spare a beam?

Steel is like money. When you need it, you need it *badly*. That's why we have many steel plants to give next-door service most anywhere.

But lately it's getting so we hesitate to open the mail or answer the phone. We *know* there will be friends asking for steel—steel they need badly—and often we just are not able to fill the bill.

And here's what's causing it all

For a while it looked as though production would soon catch up with demand. Now that time seems more distant. The many things holding up top steel production have been slow to clear away. Unpredictable stoppages keep popping up, and shortages have brought other delays. You know about many of them. We've been doing our best, but for reasons beyond our control, we're still getting orders we can't fill.

But remember this:

One of these years the steel situation is going to change for the better. When that happens our plants will be among the first to stock products now hard to get and we'll burn up the roads rushing your steel to you. In preparation for that day, we're improving and expanding facilities, to protect the quality of Ryerson steel and ship it to you faster.

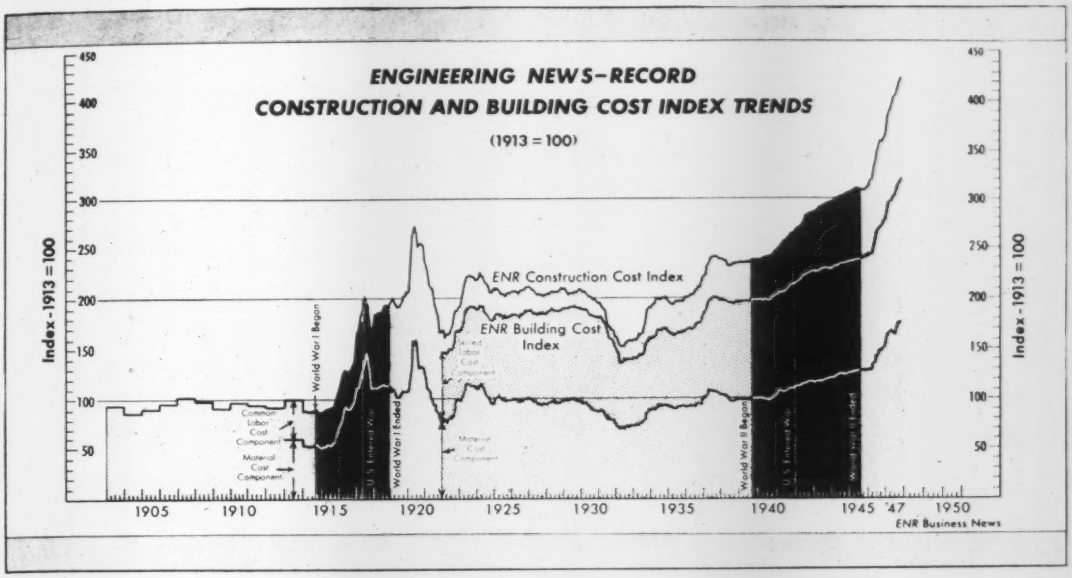
We are even now building a new plant and adding extensively to equipment at 12 others.

Meanwhile, the steel you need or a practical alternate may be in stock. So contact the nearest Ryerson plant with the full knowledge that we will do everything in our power to work with you.

JOSEPH T. RYERSON & SON, Inc. Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

NOVEMBER CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	October 1946 (5 wk.)	October 1947 (5 wk.)	% Change	Ten Months 1946 (44 wk.)	Ten Months 1947 (44 wk.)	% Change
Total U. S. Construction	$488,457	$575,089	+18	$4,547,354	$4,681,491	+3
Private Construction	292,441	350,736	+20	2,776,636	2,671,049	−4
Public Construction	196,016	224,353	+14	1,770,718	2,010,442	+14
Federal	18,211	30,763	+69	534,064	523,877	−2
E N R Construction Volume Index, 1913 = 100	233	234	+0.4	261	229	−12
Total New Productive Capital	113,962	325,628	+186	2,995,821	2,844,599	−5
Private Investment	113,962	325,628	+186	1,056,126	1,778,159	+68
Federal (non-federal work)	.....	.....	.....	225,000	247,711	+10
Federal (federal work)	.....	.....	.....	1,714,695	818,729	−52

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Nov., 1947	429 30	206 18	322 27	174 00		
Oct., 1947	424 41	204 01	320 58	173 30	234	103
Sept., 1947	417 81	200 84	317 08	171 40	255	112
Aug., 1947	415 00	199 49	313 03	169 21	215	94
July, 1947	406 52	195 41	304 87	164 80	222	97
June, 1947	403 29	193 86	303 14	163 87	276	121
May, 1947	396 49	190 59	299 61	161 96	224	98
Apr., 1947	396 09	190 40	300 81	162 61	247	108
Mar., 1947	391 95	188 41	298 84	161 54	220	96
Feb., 1947	390 76	187 84	297 65	160 90	197	86
Jan., 1947	381 68	183 47	289 05	156 25	195	86
Dec., 1946	368 10	176 95	278 77	150 69	207	91
Nov., 1946	362 47	174 24	273 99	148 11	164	72
Oct., 1946	360 94	173 50	273 01	147 58	233	102
1946 (Av.)	345 94	166 29	262 25	141 76	248	109
1945 (Av.)	307 75	147 93	239 14	129 27	123	54
1944 (Av.)	298 72	143 59	234 73	126 89	96	42
1943 (Av.)	289 95	139 38	228 75	123 66	176	77

CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	November 1946	November 1947	% Change	Change October to November 1946 Oct.	1946 Nov.	1946 %	1947 Oct.	1947 Nov.	1947 %
E N R Constr. Cost Index†	362.47	429.30	+18.44	360.94	362.47	+0.42	424.41	429.30	+1.15
E N R Building Cost Index†	273.99	322.27	+17.62	273.01	273.99	+0.36	320.58	322.27	+0.53

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.077	$1.260	+16.99	$1.072	$1.077	+0.47	$1.244	$1.260	+1.29
Skilled Labor(Av.3 Trades)	1.861	2.120	+13.92	1.853	1.861	+0.43	2.120	2.120	0.0
Bricklayers	1.981	2.252	+13.68	1.975	1.981	+0.30	2.252	2.252	0.0
Structural Ironworkers	1.865	2.147	+15.12	1.860	1.865	+0.27	2.147	2.147	0.0
Carpenters	1.738	1.963	+12.95	1.725	1.738	+0.75	1.963	1.963	0.0
Structural Steel, base	2.35	2.80	+19.15	2.35	2.35	0.0	2.80	2.80	0.0
Sand, per ton	1.517	1.824	+20.24	1.501	1.517	+1.07	1.819	1.824	+0.27
Lumber, 2x4 Fir, per M ft.	69.780	92.931	+33.18	69.780	69.780	0.0	91.847	92.931	+1.18
Lumber, 2x4 Pine, per M ft.	64.311	85.54	+33.01	63.418	64.311	+1.41	83.040	85.54	+3.01
Common brick, per M	22.225	23.813	+7.15	22.225	22.225	0.0	23.713	23.813	+0.42
Ready-mixed concrete, c.y.	8.323	9.261	+11.27	8.315	8.323	+0.10	9.261	9.261	0.0
Struct. clay tile, 3x12x12	98.379	117.96	+19.90	98.232	98.379	+0.15	117.58	117.96	+0.32

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	October 1946	October 1947	% Change	Sept. 1947	% Change Sept. to Oct.
Steel (% operating Capacity) A.I.S.I. Weekly average	90.2	96.3	+7	90.1	+7

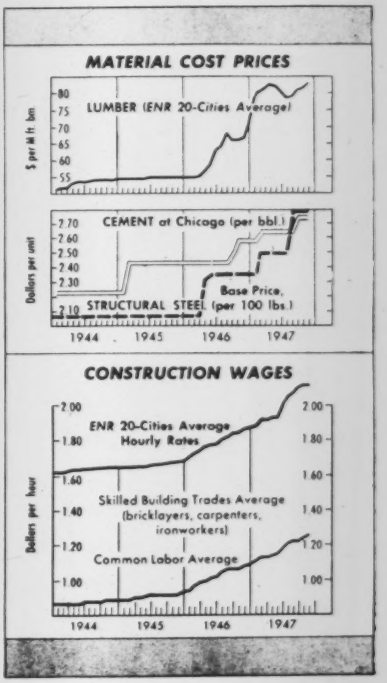
	August 1946	August 1947	% Change	Eight Months 1946	Eight Months 1947	% Change
Cement, thous. bbl. U.S.B. of Mines	17,955	20,362	+13	108,165	118,344	+9

	September 1946	September 1947	% Change	Nine Months 1946	Nine Months 1947	% Change
Fabricated Structural Steel, tons, A.I.S.C.	141,933	150,952	+6	1,087,532	1,331,457	+22
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$176,492	$307,560	+74	$2,079,056	$2,162,631	+4

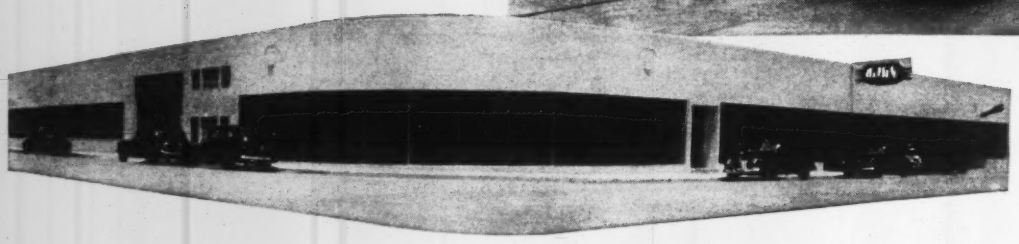
COST OF LIVING INDEX . . . . EMPLOYMENT

Base 1935–39 = 100	1941	August 1946	August 1947	% Change 1946 to 1947	July 1947	% Change July to Aug.
Consumers' Price Index, B L S	105.2	143.7	160.3	+11.6	158.4	+1.2
Rent (Housing) Index, B L S	106.2	108.7	111.2	+2.3	110.0	+0.1

Constr. Employment (est.), thous., B L S . . . .
Private Constr. Employ. (est.), thous., B L S . . } *Monthly series discontinued by Bureau of Labor Statistics.*



Inside...



Bird-Kultgen Ford Sales & Service Building, Waco, Texas. Engineer and Architect, H. L. Spicer; Contractor, C. C. Ramsey; Concrete furnished by Waco Ready Mix Concrete Co. and Clark Transit Mix Concrete Co., all of Waco, Texas.

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ENR-D-56

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News of the Week

ENGINEERING NEWS-RECORD • NOVEMBER 13, 1947 • VOLUME 139 • NUMBER 20

Approve first application for federal hospital money

Alabama group gets first funds in $1.1 billion, five-year health program—Several hundred similar applications expected by Public Health Service

Approval of the first application for federal aid under the five year, $1,125,000,000 civilian hospital construction program was announced Nov. 5 by Surgeon General Thomas Parran of the U. S. Public Health Service.

The project calls for construction of a $1,663,000 general hospital and health center by the Chattahoochee Valley Hospital Society at Langdale, Chambers County, Ala. The federal share of the cost will be $553,000.

The project is the first of several hundred expected to be carried out under the Hospital Survey and Construction Act—Public Law 725—passed last year by the 79th Congress (*ENR* Sept. 26, 1946, vol. p. 412).

This law, written primarily to assist rural and small-town areas, has two principal features: It authorizes federal grants totalling $3,000,000 to assist the states in surveying their health facility needs and in drawing up long-range construction plans; and authorizes grants totalling $75,000,000 annually for five years to assist the states, local governmental groups, and non-profit organizations in building health facilities. Each dollar of the federal funds must be matched by two from state or local sources, which makes a total of $1,125,000,000 that may be spent on construction during the next five-year period.

Population is basis

Last summer, Congress also passed an appropriation bill supplying the U. S. Public Health Service with $75,000,000 in contract authority to start the construction program (*ENR* July 31, vol. p. 146 and June 12 vol. p. 919). It is with this contract authority that the first grant has been made.

The share to which each state is entitled from the $3,000,000 survey and planning fund was based solely on the population of the individual states.

To determine the distribution of the construction funds, a formula taking into consideration both U. S. population and per capita income of each state is used. Preliminary allotments of the fund for surveys, and of the $75,000,000 of contract authority for construction work this year was given in table form in the Sept. 26, 1946, issue of this journal.

To date, 25 states have completed their comprehensive plans for civilian hospitals, the PHS reports. A number of additional requests for federal aid for construction, based on these completed plans, are expected to be received shortly. Already, 50 preliminary applications have been submitted for tentative approval. The program is moving forward with sufficient speed that the actual start of construction will be possible on several projects before the end of the year, officials added.

VA hospital plans revised to get bids

In an effort to obtain enough construction bids to enable work to begin immediately on the 17 Veterans Administration hospitals being built by the Corps of Engineers to be contracted for prior to Jan. 1, numerous revisions have been made in the plans and specifications, it is announced by Lt. Gen. R. A. Wheeler, Chief of Engineers. With the revisions designed to reduce construction costs, it is expected that the work can be started promptly.

At the same time, General Wheeler said that the requirement for Saturday, Sunday and holiday work has been eliminated. By taking away this requirement, which previously had been carried in all Corps of Engineers specifications to expedite work on the hospitals, contractors will now be able to figure with more certainty on labor costs. It will, in effect, establish a 44-hr. week for this class of work and eliminate premium payments for overtime.

All bids will be awarded within 30 days of the opening date. These and other changes were made to meet the objections of contractors who might be reluctant to re-bid on projects previously advertised. The new 30-day award clause is important, since the Corps previously has made awards within a 60-day period.

Award $22 million Chicago sewer job

Trustees of the Sanitary District of Chicago Nov. 6 voted to award a $22,631,860 contract for additions to its south side interceptor sewer to the S. A. Healy Co. of Chicago, and Peter Kiewit Sons Co., of Omaha, Neb.

The joint venturers presented the only bids for the contract sections at a bid opening Oct. 23.

Originally, bids were called for early in September, and although the same two joint venturers were low, all bids were rejected when trustees said unofficially that the low bid was some $5,400,000 above the engineers' estimates for carrying out the work (*ENR* Oct 9, vol. p. 487).

The new bid is $430,000 below the one rejected earlier.

Receive bids on aqueduct to increase Boston supply

Contract is expected to be awarded soon for a five-mile water-supply tunnel near the city of Newton, Mass.

The tunnel will furnish a natural pressure aqueduct running from the Newton-Weston line to the Chestnut Hill reservoir supplying Boston, carrying waters from Quabbin Reservoir and other upstate catchment areas into the Boston district without pumping.

Low bidder for the job at a recent bid opening was a combine of four contracting organizations which bid $9,500,000. The group includes S. Perrini & Sons, Inc.; Walsh Construction Co.; C. J. Maney Co., Inc., and the Rugo Construction Co., Inc.

The tunnel will be a 15-ft. diameter tube through solid rock.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—Contracts totalling $1,289,300 for new buildings and improvements for 10 *Illinois* welfare institutions have been approved by the state Department of Public Works and Buildings . . . Governor James H. Duff of *Pennsylvania* has allocated another $1,000,000 for improvements at mental hospitals . . . *Watertown, N. Y.*, has voted $190,000 in municipal bonds for a memorial stadium . . . First contracts have been awarded for construction of a $2,000,000 library at Eastern Illinois State College at *Charleston, Ill.* . . . Alumni of Phillips Andover Academy, *Andover, Mass.*, have launched a drive for a $1,000,000 war-memorial gym.

Industrial Construction—The Carborundum Co., *Niagara Falls, N. Y.*, has started a $15,000,000 expansion and modernization program . . . Orville W. Wise has been awarded the general contract for the construction of a $1,200,000 brick-faced addition to the International Harvester Co's machine shop and assembly plant in *Indianapolis, Ind.* . . . Bemis Bro. Bag Co. has bought a 15-acre site in Hopkins, a suburb of *Minneapolis, Minn.*, for the construction of additional plant facilities. . . . Expansion to cost $30,000,000 in the next 5 years—two-thirds of it in the next 2 years—have been announced by the Delaware Power & Light Co., *Wilmington, Del.* . . . The Union Pacific Railroad will spend $180,000,000 on construction and new equipment in the next few years, including a new $3,500,000 classification yard at *North Platte, Neb.* . . . Northwestern Life Insurance Co. will start work soon on a home office building at *Seattle, Wash.*, to cost $1,250,000. . . . Davenport, Inc., will build a $1,250,000 tourists' lodge at *Spokane, Wash.* . . . Atlantic Carton Co. has plans for a $3,000,000 paper plant expansion at *Norwich, Conn.* . . . At *Racine, Wis.*, S. C. Johnson & Son, Inc., has started building the 15-story wax research tower, chief feature of a new laboratory designed for the company by Frank Lloyd Wright. Construction will be directed by Wiltscheck and Nelson, Inc.

Highways—*North Carolina* is spending $65,531,388 on roads and highways this year—an increase of $16,000,000 over last year . . . Work is starting on $618,000 worth of street repairs in *Miami, Fla.*, made necessary by the recent storms and floods . . . Governor W. Preston Lane of *Maryland* will ask the state legislature to authorize the use of highway-bond funds for roads other than expressways and limited access highways . . . Governor Dwight H. Green of *Illinois* has released $7,500,000 for farm-to-market roads.

Housing—A total of 18,632 permits for the construction of homes have been issued so far this year in *Chicago, Ill.* . . . Ground will be broken soon for an estimated 2,800 homes and business buildings on a 406-acre cooperative Negro community project near *Jeffersonville, Ind.* George Barker, Minneapolis, Minn., is the developer . . . *Boston, Mass.*, has received federal approval for construction of the $5,500,000 South End-Cathedral low-rent housing project. Units for 508 families will be built. . . . Rezoning is to be sought to permit the building of a $500,000 apartment house on Broom Street, *Wilmington, Del.* . . . Construction of a $4,000,000 apartment project is under way at *Oakland, Calif.* F. F. Porter Co. said the first building will be completed in 4 months and 11 others will be started at one-month intervals . . . Shively, Keel and Tingle are erecting a group of 112 five-room and six-room, ranch-style houses of concrete, and lightweight slag masonry in the southwestern part of *Lumbard*, a suburb of *Chicago, Ill.*

Urge extra water stores for power loss

Because modern waterworks are so completely electrified that interruptions by power failures can produce serious health and fire hazards, waterworks systems should include extra storage facilities, members of the New Jersey section of the American Water Works Association were warned last week.

Meeting at Atlantic City, the group heard the warning from A. C. Hutson, assistant chief engineer, National Board of Fire Underwriters, in one of the principal addresses of the meeting.

To provide service during such power breakdowns, Mr. Hutson recommended that water systems carry storage facilities capable of supplying maximum 24-hour demands for two days, as well as fire-flow needs for a required number of hours determined by the size of the city.

Additionally, he said, water systems should be equipped with standby steam or internal combustion powered generators, to operate essential treatment units. Control equipment and panels should be duplicated, or at least sectionalized, the engineer advised, to meet emergency conditions.

Fluorine experiment proposed

Speaking on fluorine in water supplies in relation to dental health, Dr. J. M. Wisan, chief, division of dental hygiene, New Jersey State Department of Health, urged that one or more full-scale, carefully controlled, experiments be set up in New Jersey to find out what effect the application of one part per million of fluorine to public water supplies will have on dental health. At the present time such experimentation is being carried out in a half dozen states and Canada.

Legal matters

In a symposium on the liability for damage resulting from water operations and appurtenances, Harold M. Ohland, hydraulic engineer, of the Jersey City department, advised that repairs should be made as soon as possible after discovery of the need. Complete records of what was done and when it was done should be kept. He said that court cases had often been won on the basis of a complete record of the repair work that was included in the evidence.

To defray damage costs arising from leaks causing undermining, Charles G. Bourgin, superintendent of the Montclair bureau of water supply, advised that public liability and property damage insurance be carried by water utilities.

Injuries caused by projecting curb boxes were discussed by Ralph L. Tyler, Water Utilities Corp., Camden, N. J. As a general rule curb boxes are not inspected because of other more essential work. With claims from curb-box-caused injuries on the increase, Mr. Tyler said that water works administrator would do well to consider a regular inspection program.

THE COVER PICTURE

An aluminum panel-faced microwave tower, 300 ft. high and 22 x 42 ft. in section, will be used for experiments with antennae at the Federal Telecommunication Laboratories now under construction at Nutley, N. J., by the George A. Fuller Co.

A description of this project is included in the special section in this issue "Toward Low-Cost Building" (vol. p. 670).

Strikes balk N. Y., Phila. tunnel work

After some weeks of relative quiet, the construction labor pot began to bubble again last week as new demands for higher wages were presented to employers.

The biggest construction job affected appeared to be New York City's Brooklyn-Battery Tunnel which was shut down for the fifth time in less than two years by a strike of union "sandhogs", and Philadelphia's $6,700,000 Market St. subway extension.

The $71,000,000 Brooklyn-Battery tunnel work was shut down when union leaders demanded an additional $2 a day for the underground workers, claiming that although they held contracts with the two contractors working at either end of the tunnel, no contract was signed for work now being pushed from a shaft driven near the tunnel's center at Governors Island in New York harbor.

Officials of the New York City Tunnel Authority, which owns the new artery that will connect the city's business area with populous Brooklyn, announced in newspaper advertisements that it considered the strike to have no sound basis. Officials of the two contracting firms, the George H. Flinn Corporation and the Mason & Hanger Company made no official comment but indicated that they would close down the work for the winter if the strike continued much longer.

Ten-cent dispute

In Philadelphia, the High Speed Line of the Market St. subway has been held up since September 19 as a result of a dispute over a ten-cents-an-hour differential for one worker. The situation was disclosed when the Contractors Association of Philadelphia filed a bill of equity in Common Pleas Court there in an effort to compel the union to submit the dispute to arbitration. The worker, it is contended, is a crane operator and a member of Local 542, International Union of Operating Engineers, an AFL affiliate. The union has insisted on a rate of $2.50 an hour for this man because he is performing what the union contends is "subway" work. The contractor, also the George H. Flinn Corp. of New York, maintains that the man is doing normal highway work and should be paid $2.40 an hour.

Meanwhile negotiations were continued between representatives of the New York City Building Trades Employers Association and the major building unions of the American Federation of Labor looking toward a 2½ year agreement to stabilize construction costs and encourage public and private builders.

The chief stumbling block to negotiations was reported to be a union demand that in addition to wage increases now, a clause should be included permitting wage adjustments up to 15 percent, should the cost of living continue to climb.

Attack legislation

In two other states, both of which passed "right to work" bills during their last legislative sessions, court tests of the measures neared.

In Nebraska, the state supreme court began hearings on a case to test the constitutionality of the state's "anti-closed shop" amendment, on an appeal from an adverse decision filed by the Lincoln Federal Labor Union.

In Arizona the state supreme court was asked to put a permanent end to the review of the petitions which placed the right-to-work measure on the ballot last fall. A lower court had appointed a special master to canvass the petitions after organized labor had charged that many of the signatures obtained were invalid.

In Rhode Island, the Rhode Island Association of General Contractors on Oct. 29 agreed to end overtime work on construction projects handled by their members. Raymond G. Williams, of Warren, secretary of the organization, said that all projects are to be carried forward on a 40-hour week instead of the current 40 to 54 hours.

Conemaugh bridge failure opens Penna. controversy

The Pittsburgh, Pa. district office of the Corps of Engineers last week found itself fighting a verbal battle with one of the state's congressmen, while employees began rebuilding a damaged pier of a new railroad bridge.

The bridge is part of a relocation of the main line tracks of the Pennsylvania Railroad necessitated by construction of the $34,000,000 Conemaugh Dam, preparatory work for which is now under way. The reinforced concrete pier failed under pressure from a sliding landfill.

The "battle" started with a local newspaper's publication of charges by Rep. James G. Fulton that taxpayers' money is being wasted because of faulty engineering at the relocation project. Representative Fulton said that "a serious construction error" had occurred in the construction of bridge foundations, which permitted the bridge pier to be pushed several feet out of line.

Col. F. H. Faulkner, district engineer at Pittsburgh, explained that the area at the site was excavated to rock, and the foundation for the structure was placed on this rock. "When the area was backfilled," he commented, "seepage developed, saturated the fill and caused it to slide, exerting excess pressure against the abutment and the first pier. The pier was moved out of alignment and sheared 10 ft. above the foundation.

"There was no damage to the foundation and there is no concern about foundation conditions. There will be no delay on the project as a whole."

***Adds Hangar Space**—Delta Air Lines has more than doubled its available office, shop and hangar space at its headquarters at Atlanta Municipal Airport, Atlanta, Ga. Executive and general offices are located in the two-story structure in the foreground, and shop and office space are in the building flanking a new 187-ft.-span hangar at right. Asbestos-protected metal used in the roof deck is supported on steel trusses.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Building code changes come to fore—Grade crossing eliminations planned at Indianapolis, Camden and Akron

Changes in local and state building codes to meet the continuing demand for housing and for modernization occupied the attention of city engineering officials last week.

Commissioners of Franklin County (Columbus), Ohio, cleared the way for construction of small prefabricated homes by adopting a resolution relaxing provisions of the county building code to permit construction of prefabricated homes in units of 50 or more. Commissioners will insist, however, on approving location, installation of utilities, roadways, size of the building lots and other facilities that may be laid out in connection with such projects.

At Montreal, Canada, the first new building code since 1901 was in the hands of the city council for study pending a special meeting to be held late this month. The new code, prepared by Aime Cousineau, director of the Town Planning Department, consolidates all of the existing code and the 36 amendments made since 1901, and brings into the code many of the new developments in construction of recent years.

In Massachusetts, recent legislation authorizes the Board of Standards of the State Department of Public Safety to pass on the adequacy of new materials or methods of construction, regardless of local codes. The board has already started work to determine specified requirements for strength, durability and fire resistance of molded plywood, glass fiber and synthetic plastics, and for such new methods as metal and plywood stressed-skin or wide-spaced frame and curtain wall construction.

Beach problems

Dredging of the channel at Anaheim Bay at Seal Beach, Calif., just south of Long Beach, will produce more than 1,000,000 cu.yd. of sand which will be pumped onto the beach front to reclaim more than one-quarter mile of eroded waterfront property, city officials said.

The erosion is attributed to tidal action resulting from construction by the federal government of a jetty at the Seal Beach naval ammunition depot.

At Fairfield, Conn., the City Park Commission named a subcommittee of five men to make a study and survey of methods used to control beaches in various sections of the country.

The committee is to draw up recommendations for an overhaul of the present beach regulations and other beaches bordering the town waterfront.

Grade elimination plans

The Indiana State Highway Commission and the Indianapolis Union Railway Co. last week approved plans for construction of a $1,000,000 underpass on Kentucky Ave. at the railroad crossing near the Union Stock Yards. Surveys have shown that about 12,000 vehicles cross the six railroad tracks at the point of grade separation each day.

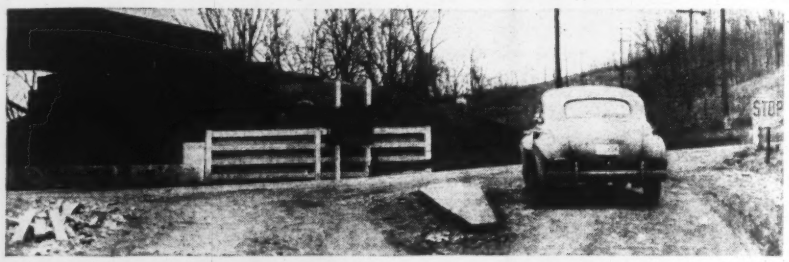
Akron, Ohio, city engineers produced a topographical map and diagram to show citizens their plans for a superhighway across a portion of the city connecting the Gorge bridge to Cuyahoga Falls on the north of the city.

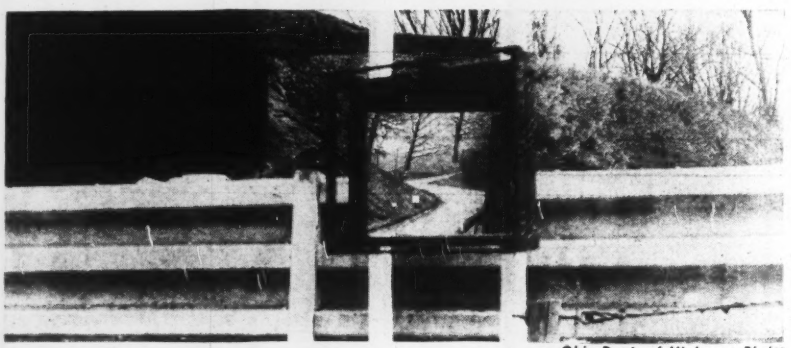
At Camden, N. J., a committee of engineers including F. L. Girard and E. T. Osborne of the state highway department and Thomas J. Daly, Camden city engineer, was appointed to prepare plans for elimination of street-level railroad crossings in the city. The committee was formed following a conference between state highway department officials and representatives of the city, the Delaware River Joint Commission, Camden county and the Pennsylvania Railroad.

In Chicago, work has started on the new Congress Street superhighway from the Loop district of Chicago westward to the city limits and beyond. Present work consists of clearing buildings from the highway route, placing heavy steel beams below railroad tracks just south of the LaSalle Street Station, and driving the Milwaukee Avenue-Dearborn Street subway under the downtown right-of-way between Dearborn Street and the Chicago River.

Water, sewer projects

Mayor George R. Phillips of Pocatello, Idaho, said recently that the city plans to spend between $400,000 and $1,000,000 on a city sewage disposal plant, depending on the city's ability to raise funds through a bond issue. Other sewer plant plans included: Final plans





Ohio Dept. of Highways Photos

Mirror Trick *—Facing the problem of an intersection of a little-used country road and a heavily travelled state highway at right angles, complicated by masking hills, a railroad overpass and terrain features that cut sight distance to less than 60 ft., Ohio Department of Highway engineers solved the problem with mirrors. The intersection—junction of township road and State Route 9 near St. Clairsville—was provided with a 30x36 in. mirror, mounted in a weather-protected frame, facing traffic entering the main road from Township Road. It gives motorists a view of the main-travelled roadway extending some 500 ft. through the overpass.*

for construction of a $1,500,000 disposal plant for Tulsa, Okla., prepared by the Kansas City firm of Black & Veatch and Victor H. Cochrane, of Tulsa, were presented to city officials; and the approval of a $440,000 bond issue for Indianapolis, Ind., to finance construction of sewers in that city.

While cities planned new disposal plants, new action was developing on the stream pollution front.

At Toledo, Ohio, the city council threatened court action against three manufacturing concerns unless they made good on what councilmen said was their promise to cooperate with the city's stream pollution program. The three companies, according to the council, had pledged cooperation in eliminating pollution emanating from their plants, but had done nothing about their pledge for more than a year.

The State of Pennsylvania discovered that it would have to pay about $29,000,000 as its share of the cost of cleaning up the Schuylkill River—a figure almost double the original estimate. Milo F. Draemel, secretary of Forests and Waters, said the added cost is due to skyrocketing material and labor costs.

Cleveland airport terminal

A definite program to build a modern passenger terminal at Cleveland Airport, to replace an overcrowded 18-year-old structure, was announced by Mayor Thomas A. Burke.

Mr. Burke said the city council will be asked to enact legislation authorizing a survey of possible sources of revenue from an up-to-date terminal building.

DOGGED WORK PLUGS PIPE

Puppy love came to the aid of engineers at Milford, Ohio, recently, to help repair a broken water main.

A 10-in. dia. concrete pipe used to transport water to the Feldman Farm and Home Center—one of the world's largest frozen foods locker plants—cracked open under pressure.

After several unsuccessful efforts to snake a line through the small-diameter pipe, engineers finally hit on the idea of using "Pit"—a short-legged Beagle—to get the line through. They placed one of the dog's puppies at one end of the pipe—200 ft. from its mother.

Placed at the other end of the conduit, "Pit" heard the pup's whimpering, and ran unflinchingly through the dank pipe—pulling through a length of twine attached to her collar. A heavier rope, carrying necessary repair materials, was then put through.

New commercial standard for prefabs effective

A revised commercial standard for prefabricated homes, issued by the U. S. Department of Commerce with approval of the National Bureau of Standards, will be effective for new production beginning Nov. 25.

Designed to improve quality, this standard was proposed to the Bureau of Standards by the Prefabricated Home Manufacturers' Institute about six months ago, and circulated through the industry for comment. After minor adjustments, the present standard, known as CS 125-47, was accepted.

In general, it is a tightening up of the old standard issued in May, 1945, with more specific regulations to meet standard building code requirements. A spokesman pointed out that during the war prefabricated homes had to be built with emphasis on speedy construction and low costs, frequently resulting in ugly homes with inferior workmanship.

Requirements in CS 125-47 are mainly of the performance-standards type. Walls, roof, floors, etc., must measure up to certain performance tests, whatever the materials may be. Prefabricated homes built to specifications of the new standard will carry with them "certificates of conformity."

The code provides minimum requirements for 1, 1½, and 2-story homes and covers definite requirements for light, ventilation, space access, structural strength of various component parts, thermal insulation and condensation control, as well as specific requirements for heating, plumbing, and electric wiring.

Copies of the standard are now available at Commodity Standards Division, National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C. Later on the standard will be a part of a pamphlet entitled "Prefabricated Homes" (Second Edition) Commercial Standard CS 125-47.

Plan $65 million mill for N. B. paper company

The second of a series of conferences on a proposed $65,000,000 New Brunswick newsprint mill has been held by its promoters, headed by Frederick C. Bagley of Augusta, Me.

Plans call for a 4-machine plant with an initial capacity of 1,000 tons of newsprint per day which it is said would make it the largest mill in Canada.

The mill would be at Lepreau, Charlotte County, N. B., on the Bay of Fundy.

Hopper for Housing — A buggy-loading hopper, cantilevered outside the steel frame, provides convenient entry for floor slab concrete for the Abraham Lincoln Houses, now under construction at 132nd St. and Park Ave. in New York City. Concreting is being done by Knickerbocker Concrete Arch Construction Co. on the New York City Housing Authority project. Steel was erected by the Harris Structural Steel Company.

Urge nation-wide building code work

U. S. building officials must disregard geographical boundaries and cooperate on a national scale in order to bring about better and more uniform building codes, Pacific Coast builders were told last week.

The occasion was the silver anniversary meeting of the Pacific Coast Building Officials Conference and the Uniform Building Code Association, at Grand Canyon, Ariz.

Keynoting the meeting, James W. Follin, assistant administrator of the Federal Works Agency, pointed out that a great deal of misinformation now exists in the public mind as to building codes.

"These codes are being blamed for practically everything that is wrong in the building business, whether or not they are involved," Mr. Follin said. "The public does not differentiate between the various types of regulations.

Mr. Follin urged a four-step program for the housing industry to improve public relations. He suggested the adoption of model codes; efforts to improve the status of building departments, including adequate pay scales; advancement of technical improvement and insuring flexibility in the codes; and securing public acceptance and goodwill.

OOPS!

Omission of certain cost figures on a construction contract cost a New York contracting firm $100,000 last week.

The firm, Foley Brothers, Inc. of Pleasantville, N. Y. chose to forfeit its $100,000 bond rather than take a contract for which it had successfully bid, involving construction of piers for a bridge across the Schuylkill River at Philadelphia, Pa.

The reason: company experts forgot to figure in the cost of forms for pouring concrete—a $700,000 item. Forfeiting the guarantee was cheaper than doing the job. The company had submitted a bid of $5,133,857 for the work—nearly $1,000,000 under the nearest competitor.

The Pennsylvania State Highway Department, which had promptly awarded the job, said the project will be readvertised.

ARBA schedules meeting on highway problems

A 3-day meeting for the open discussion of current highway problems, both technical and otherwise, has been scheduled for Jan. 26-28 by the American Road Builders Association.

The meetings will be held in three hotels in Washington, D. C.

The meeting will also be the occasion for the annual meetings of the Municipal Division; the Airport Division; the County Highway Officials Division; and the American Institute of Local Highway Administration, County Highway Officials Division.

The meeting will serve as a prelude to the ARBA annual Road Show, scheduled to be held in Chicago in conjunction with its 45th annual convention from July 16 to 24. The Road Show (*ENR* May 8, vol. p. 783) will be the first held by the organization in eight years.

Ask bids on $27 million Mystic River bridge

The Mystic River Bridge Authority last week advertised for bids for construction of a new $27,000,000 high-level toll bridge over the Mystic River in Boston, Mass.

The authority, which recently sold bonds to finance start of the work, said that it expected the successful contractor to begin work early in 1948. The structure is to be a self-liquidating project.

Producer group sees $14 billion 1948 building

The Producers' Council, Inc., last week estimated that physical volume of new construction will be about $14,000,000,000.

David S. Miller, council president, said that the organization's economists place 1948 building volume at about 13 percent higher than in 1947. "New private building in 1948 is estimated at $10.2 billion, an increase of 8 percent over 1947, while public construction is estimated at $3.8 billion, or 30 percent greater than in 1947," Mr. Miller said. "On this basis, public works would account for 27 percent of all new construction, as against 24 percent this year and 22 percent in 1946.

The statement from the Producers Council was the third recent announcement from authoritative sources predicting an increase in construction business for 1948.

A month ago Maj. Gen. Philip B. Fleming, Federal Works Administrator, addressing the Producers' Council, in New York City, predicted that construction volume for 1948 would approximate $13 billion (*ENR* Oct. 9, vol. p. 487). *Engineering News-Record*, which is now seeing its prediction for 1947 substantially confirmed, two weeks ago predicted a 5 to 25 percent rise in dollar volume of construction for 1948.

Amplifying the Producers' Council statement, Mr. Miller said that private residential construction is expected to rise 12 percent in dollar volume, an increase of 25 percent is anticipated in commercial building; 11 percent in farm buildings, and 14 percent in public utility construction.

Creedon quits housing for atomic energy work

Frank R. Creedon, for the last year Federal Housing Expediter, resigned the post Oct. 31 to take one in private industry to "expedite the atomic energy program." Mr. Creedon, a construction engineer, said he has been appointed construction project manager at the Hanford Works near Richland, Wash., an atomic energy plant operated by the General Electric Co. for the Atomic Energy Commission. He will direct new construction work now getting under way there.

Tighe E. Woods, who has been deputy housing expediter, will take over Mr. Creedon's place in an acting capacity. Mr. Woods, a graduate of Notre Dame University, entered government service in 1942 as an OPA rent examiner.

Suit tests Penna. law OK'ing insurance housing

The Pennsylvania Supreme Court, sitting at Philadelphia is hearing arguments in a suit testing the constitutionality of a 1947 law permitting investment of insurance company funds in Pennsylvania housing.

Ralph B. Umstead, deputy attorney general, commented that "the state takes the position that this is a matter of great public concern in that the law is designed to help end the present acute housing shortage." The Justice Department, he added, will file a brief and argue the case before the court.

The suit was brought by Grant Levi, policyholder in the New York Life Insurance Co., and asserts that under the Pennsylvania constitution insurance firms are forbidden from holding real estate "except as needed for their legitimate business."

The new law, passed at the last session of the state legislature, permits life insurance companies to invest up to 10 percent of their assets in housing.

Yakima River channel contract is let

A contract for excavating a pilot channel on the Yakima River at the scene of an earth slide near Cle Elum, Wash., which wrecked the Milwaukee railroad tracks in August and diverted the river's flow (*ENR* Oct 23 vol. p. 557) has been awarded by Col. L. H. Hewitt, district Army engineer at Seattle, to J. A. Terteling & Sons, Inc., for $43,750.

Colonel Hewitt said the project is designed to avert flooding of farm land in the vicinity and to prevent additional damage to the Northern Pacific railroad track and the state highway on the opposite side of the river from the slide.

MAJOR MEETINGS

National Association of Housing officials, 14th annual meeting, Hotel New Yorker, New York, N. Y., Nov. 17-20.

Construction Industry Advisory Council, fall meeting, Hall of Flags, National Chamber Building, Washington, D. C., Nov. 19-20.

Highway Research Board, 27th annual meeting, National Academy of Sciences and National Research Council, Washington, D. C., Dec. 2-5.

National Society of Professional Engineers, Statler Hotel, Buffalo, N. Y., Dec. 4-6.

Society for Experimental Stress Analysis, annual meeting, Hotel Pennsylvania, New York, N. Y., Dec. 4-6.

OBITUARY

Philip Henry, 83, New York consulting engineer, vice-president and secretary of the American Institute of Consulting Engineers, and vice-president and trustee of Rensselaer Polytechnic Institute, died Nov. 7. Graduated from R. P. I. in 1887, Mr. Henry had engaged in engineering and construction projects in Mexico, Haiti, Venezuela, Peru, Bolivia, Argentina, Spain, China and in this country, where he had paved 550 miles of streets, much of that work having been in Chicago and St. Louis. He was with the Barber Asphalt Paving Co. from 1887 to 1902, becoming vice-president and general manager. He was later connected with other construction and mining companies, and from 1933 to 1935 he was a member of the technical board of review of the Public Works Administration.

Harry N. Pharr, 72, member of the Mississippi River Commission, and former chief engineer for the St. Francis Levee, Ark., district, died at Memphis, Tenn., Nov. 3.

A leader in the high water fight, Mr. Pharr's experience in levee and flood control work included the Mississippi, St. Francis, Arkansas, White, Obion, Wabash and Kansas Rivers. Few persons knew these rivers better than he.

Mr. Pharr was graduated from the University of Arkansas' School of Engineering in 1893. He became an assistant to his father, the late H. N. Pharr, chief engineer of the St. Francis Levee Board from its organization in 1893. Four years later, on the death of his father, Mr. Pharr was elected chief engineer—a post he held under nine board presidents.

Edgar A. Harper, 88, city engineer of Kansas City, Mo., from 1904 to 1908, died in that city Oct. 24. Before going to Kansas City in 1889 he had been employed three years in the engineering office of the Atchison Topeka & Santa Fe R. R. in Topeka, Kan.

Albert C. W. Siecke, 61, of the Merritt-Chapman & Scott Corp., died Oct. 15. He was educated in the New York City public schools, The Cooper Union, and Columbia University. He joined Merritt-Chapman & Scott in 1919 and, besides designing all of the company's derrick boats, had charge of the engineering connected with the corporation's marine and heavy construction, salvage and derrick activities. The U. S. Navy awarded him the Certificate of Commendation for his outstanding work in the raising of the USS Lafayette (Ex-SS Normandie).

Harold E. Libby, 62, civil engineer with the War Department for 33 years, died at Rockville Center, N. Y., Nov. 3. During the war he was in charge of the maintenance and operation of New York harbor for the Corps of Engineers. From 1933 to 1936 he was in charge of building earth dams for flood control in Vermont, for which he received an honorary degree of civil engineering from the University of Vermont. In 1932, he supervised the first comprehensive tide survey of New York waters.

Leslie R. Ames, 57, former chief engineer for the North Carolina highway commission and also for the Louisiana Highway Department, died in Raleigh, N. C., Nov. 2.

Delos B. Moorman, 87, pioneer leader in reclamation development of Idaho's Magic valley, died Oct. 20, at Murtaugh, Idaho. Prior to that he had constructed drainage projects in Skagit and Whatcom counties in Washington. He helped in building and developing the Milner Low Lift for use in irrigation of lands in Twin Falls County, Idaho.

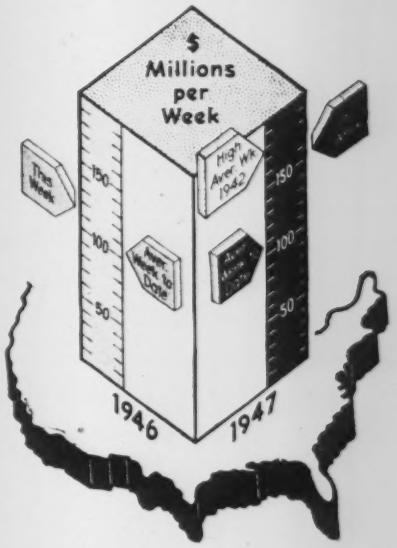
Carl Prescott Abbott, 69, former engineer for the Kensico Dam and Catskill Aqueduct for the New York City water supply, and former deputy commissioner of public works for White Plains, N. Y., died in that city Nov. 4. He was resident engineer for the American Nitrate Corp. in Muscle Shoals, Ala., during the first world war and was procurement inspector for the Army Engineers at Rye Lake Airport, N. Y., in the last war.

Minton M. Warren, 59, construction engineer, a graduate of Harvard University school of engineering, 1912, died in New York City, Nov. 4. He was an expert on hydraulic work and the technical problems of sewage tanks, air tanks and pipe lines.

Joseph C. Thoma, Jr., 40, engineer for the United States Geological Survey, died Nov. 2 in Arlington, Va.

Ralph R. Day, foreign project engineer for Sanderson & Porter, New York City, died in Cornish, Me., Nov. 1. A graduate of the University of Maine, 1911, Mr. Day was formerly with the J. G. White Engineering Corp., New York, and had worked on projects in Haiti, Brazil, Canada, Central America and Hawaii.

CONSTRUCTION ACTIVITY



As Reported this week to... *Engineering News-Record*

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Nov. 13 1947	Cumulative 1947 (46 wks)	Cumulative 1946 (46 wks)
Federal	$21,949	$554,129	$568,061
State & Mun.	64,537	1,592,330	1,288,080
Total Public.	$85,586	$2,146,459	$1,856,141
Total Private	73,741	2,791,657	2,856,662
U. S. Total..	**$159,327**	**$4,938,116**	**$4,712,803**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (46 wks)	Cumulative 1946 (46 wks)
Waterworks ...	$11,823	$106,395	$98,649
Sewerage	27,393	150,313	101,249
Bridges	3,807	166,692	119,052
Highways	8,852	707,494	709,494
Earthwork, Waterways	12,921	272,279	305,966
Buildings, Public	12,765	519,874	374,924
Industrial ...	19,757	800,354	949,424
Commercial ..	41,621	1,617,562	1,725,162
Unclassified	20,388	597,153	328,883

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (46 wks)	Cumulative 1946 (46 wks)
NON-FEDERAL ...	$2,275,756	$1,327,396
Corporate Securities	906,467	386,997
State and Municipal	1,121,578	715,399
Fed. Aid Highway.	247,711	225,000
FEDERAL	818,729	1,714,695
**Total Capital ..... **	**$3,094,485**	**$3,042,091**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost.	Nov. '47	429.30	206.36
Building Cost....	Nov. '47	322.27	174.21
Volume	Oct. '47	234	103

EDITORIALS

VOLUME 139 NUMBER 20

November 13, 1947

Reliability of Waterworks

DEPENDABILITY of electric power coupled with efficiency and economy has encouraged its widespread use in water service. But to place complete faith in this source of power—which is subject to interruption from floods, fires, hurricanes, labor troubles, fuel shortages and other uncontrollable causes—is not realistic. Hence the waterworks engineer must give special consideration to the installation of reserve power facilities and ample storage. This is the subject of a special bulletin issued by the National Board of Fire Underwriters, which was released at a meeting of the New Jersey Section of the American Water Works Association last week. Thinking not only in terms of maintaining fire protection, the underwriters properly point out that water supply is a service vitally associated with the health, sanitation and general welfare of a community. Under normal circumstances, storage facilities to supply maximum 24-hour demands for two days plus fire-service requirements should be sufficient. But to compensate for the breakdown of moving machinery, a supply for five days is recommended. And in cities that still possess steam-operated equipment it is urged that these be continued in service for standby needs and even be modernized and extended. It is certain that these recommendations will meet with a sympathetic response because reliability of service has long been one of the proudest accomplishments of waterworks practice.

Construction Speed and Spending

TWO RECENT COMMENTS by public officials on the fact that the Bureau of Reclamation may have to shut down four of its biggest construction projects before the end of the fiscal year for lack of funds emphasize that some changes in public-works practices would be helpful. Senator Styles Bridges, chairman of the Senate Appropriations Committee, says the bureau is spending its money too fast. Reclamation Commissioner Michael W. Straus says that it is unjustifiable waste deliberately to slow down construction so that it drags on with continuing non-productive overhead. Mr. Straus has a strong point in his favor. Once Congress commits itself to finance any public-works project, it should make funds available at whatever rate they can be spent most efficiently. If it is not willing to do this, the project should not be approved in the first place. On projects extending over many years, one Congress cannot, of course, firmly bind a subsequent Congress, but the general acceptance of the principle of efficiency through speed in construction would be a powerful force in that direction.

Over One Hundred Thousand

IMPRESSIVE EVIDENCE of the growing size of the engineering profession is found in the statement made at the annual meeting of the National Council of State Boards of Engineering Examiners that there now are 114,698 registered engineers in the United States and its territories. Before the war, the generally accepted figure for the number of men who could logically be classed as engineers was around 75,000, though some put it at 90,000. Now that all 48 states have registration laws we have a better measure, although it is known to be on the conservative side because there are many engineers who have not applied for registration because they are exempt or because their work is not such as to require it. Membership in the major engineering societies similarly has climbed to around 100,000 from a low of less than 60,000 in the depression. If this means anything it should indicate a growing demand for the services of engineers in an ever widening area of activities.

Assurance of Better Engineers

LAST MONTH the Engineers' Council for Professional Development marked its 15th year of service to the profession by a meeting in Montreal that gave ample evidence of virility (*ENR* Nov. 6, vol. p. 632). Those fifteen years of expanding activity have demonstrated that in the fields of education and training for young men, the diverse elements of the engineering profession can work together to their mutual advantage.

Beginning as a cooperative agency for seven engineering societies, the council now is made up of three representatives from each of eight societies, the Engineering Institute of Canada having been added in 1938. But the number of men who serve on the committees through which ECPD does most of its work runs well over 100, the largest being the

Committee on Engineering Schools, which handles accrediting work.

This accrediting of engineering school curricula is the outstanding accomplishment of ECPD. It was undertaken early in the life of ECPD in an effort to bring order out of a chaotic condition in which numerous agencies were attempting to classify engineering schools as to acceptability. An ambitious program of examination and evaluation was set up, and to insure its breadth, many engineers outside of academic fields were enlisted as examiners.

Looking back from the vantage point of today, the accrediting has been eminently successful. Evidence of this is found in the pressure that was brought on ECPD a few years ago to undertake accrediting of technical institutes and in the more recent request from South American educational authorities for some form of accrediting for their engineering courses.

Second place in ECPD accomplishments must be accorded to its work in student selection and guidance. That work was begun a decade or more ago in a small way through cooperation with local sections of the Founder Societies; now it has progressed to the point where there are continuing committees in many cities, which regularly give advice to hundreds of high-school students seeking information about the engineering profession.

About five years ago, ECPD joined with the American Society for Engineering Education and the Carnegie Foundation for the Advancement of Teaching in sponsorship of the Measurement and Guidance Project in Engineering Education. That agency developed the "pre-engineering inventory", which has proved to be a valuable guide in determining whether a boy has the aptitudes and education for engineering school work. More recently it began work on other tests for lower levels in the secondary schools and higher levels in the colleges that hold great promise as means for guiding the right types of students into engineering work and for measuring their training while in college.

Less spectacular is the work of ECPD in the preparation of literature for this guidance work and to aid young engineers after they get out of college and on canons of ethics for the profession.

Looking ahead, ECPD has only scratched the surface in its program to aid young engineers in an orderly continuation of their technical and professional development after graduation. But on its record it has provided both the United States and Canada with assurance that their future engineering requirements will be met by a body of engineers better equipped for their jobs than was the case before ECPD was organized.

Toward Low-Cost Building

MANY BUILDERS are concerned about rising construction costs, and rightfully so. They appreciate the danger of building being priced out of the market and recognize, on the other hand, that a lowering of costs will expand the market at an accelerated rate and increase their profits. Thus, they welcome suggestions for ways to cost reductions.

For these builders—and for all building designers interested in utilizing new ideas to achieve greater economies in construction—a special section, with the theme, "Toward Low-Cost Building", is presented in this issue. It contains specific examples of what some designers and builders are doing to cut costs—examples that are worthy of imitation where conditions are appropriate.

No pretense is made that the progressive practices outlined in this section are cure-alls for high prices, since it is obvious that the savings achieved through their use are only a small percentage of the total cost of building. Yet it is self-evident that these design and construction practices, in conjunction with certain other cost-reducing steps, can effect the desired results. Among such steps could be listed the removal of unnecessarily liberal contingency items from bids, an increase in the productivity of labor, improvement in the efficiency of material distribution from manufacturer to user, and a limiting of profits all along the line to reasonable amounts.

For any substantial cut in building costs to be achieved, therefore, many elements of the industry must act—manufacturers, dealers, labor, architects, engineers and contractors. If their representative organizations would all sit down at a conference table in the near future and program a definite plan of action, something real in effective cost reduction might well result.

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Fig. 1. Precasting concrete slabs from which trussed reinforcing projects to bond into cast-in-place portion of deck.

Concrete Deck Forms Are Precast Slabs

***Contents in Brief**—A concrete wharf deck combines precast and monolithic construction by first placing precast slabs of half thickness whose projecting reinforcing provides bond with the upper portion of the slab later cast in place. Shear blocks projecting from precast caps and beams aid in unifying the completed deck.*

THE WHARF at the outer end of a 4,000-ft. causeway at Richmond, Calif., which is being built by the Standard Oil Company of California, combines advantages of the precast method with the strength and integral quality to be had only in a monolithic structure. The precast slabs that constitute the lower portion of the deck structure avoid the need for expensive, over-water forms spanning the space between caps of the pile bents. By the bonding effect of the final continuous pour, all parts of the deck are united into a monolithic structure that affords maximum resistance to the horizontal thrust of vessels berthing alongside the wharf. This consideration is important because of a water depth of 35 ft. and a rather exposed location on upper San Francisco Bay. The new wharf is at the outer end of a causeway, whose construction utilized precast concrete slabs to an unusual extent, as outlined in *Engineering News Record*, Nov. 28, 1946 vol. p. 710.

With the assurance born of experience in the causeway construction, the wharf at its outer end was built on the same general policy of minimizing the over-water form work that would be expensive. It also secured the advantages of a poured-in-place structure, which was particularly desirable in the relatively large areas of the wharf. About 250,000 sq.ft. of wharf area is included in the construction now under way with the combination of precast and monolithic types.

The major portion of the current wharf construction is in two parts. One 660 ft. long x 135 ft. wide, and the other 1,800 ft. long x 112 ft. wide. This latter portion includes a 60-ft. wharf deck, a 40-ft. width for an open pipe-way, and a 12-ft. decked strip used for mooring barges.

After concrete piles for the wharf had been driven and capped, precast concrete deck slabs were barged to

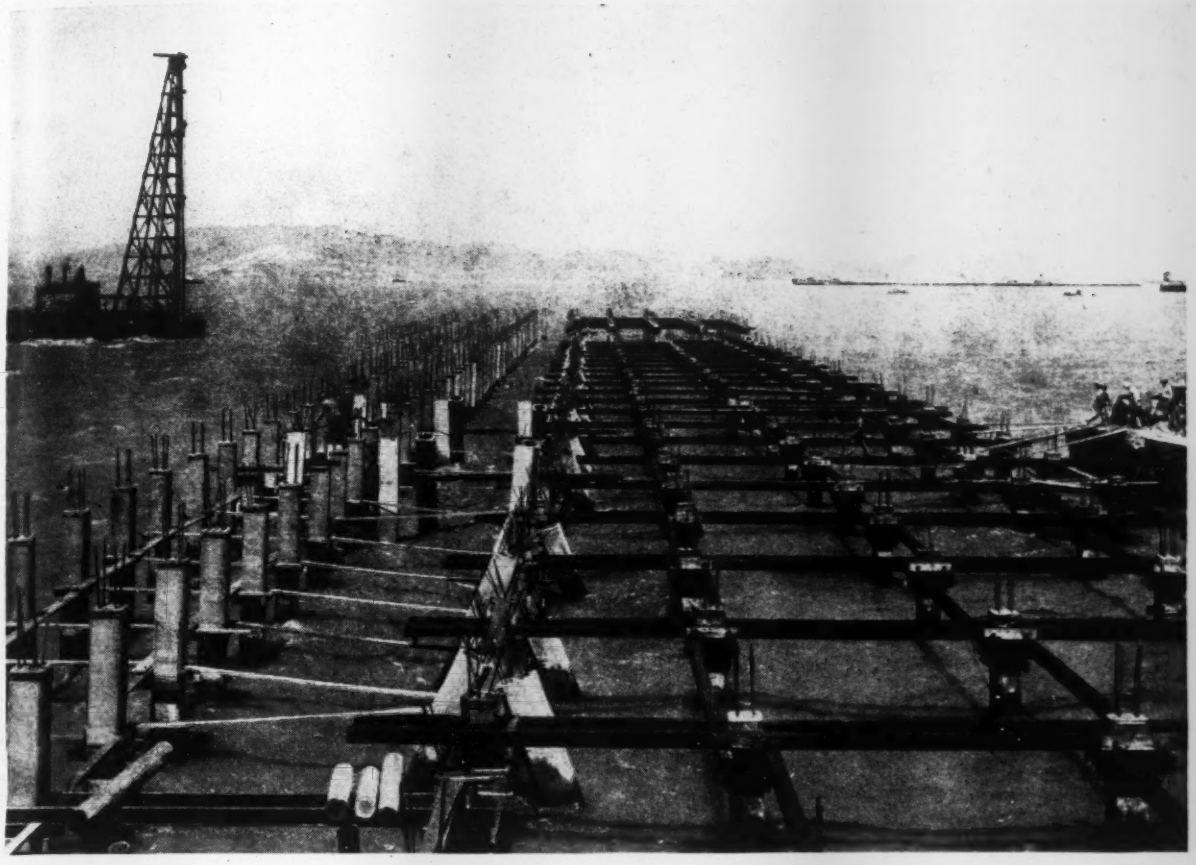

Fig. 2. This outer end of the wharf is supported on 18x18-in. piles 105 ft. long. Note uniformity of alignment. Piles were driven to exact depth; no cutting was necessary.

the job and set in place with floating equipment. These deck slabs, however, were of only half the deck thickness, including only the lower or bottom 5½ in. of the ultimate 10-in. depth. They varied in width from 6 to 13 ft. and all had the uniform span of 10 ft. 10 in. The 5½-in. thickness, with its embedded reinforcing, was adequate to support the dead weight of the slabs themselves plus the weight of the concrete that would later be poured upon them to complete the deck thickness.

The procedure at the casting yard was to embed in the precast portion of the slabs a system of reinforcing consisting of trussed bars as shown in the accompanying illustrations. The bottom chord is ¾-in. steel and the webbing as well as the top chord is ½ in. in diameter. These trusses project about half their height above the surface of the precast slab, thus affording ample bond with the portion of the slab to be cast later. The trusses measure 7¼ in. from top to bottom, thus providing a 1½-in. protective embedment of the bottom chord and 1¼ in. of the top chord. The trusses span the length from cap to cap and are spaced on 6-in. centers. This arrangement of reinforcing provides for a uniform floor load of 350 lb. per sq.ft.

Before this design won final approval, test specimens were taken to the laboratory and loaded to destruction to determine whether there was danger of slippage along the joints between precast and cast-in-place portions of the slab. These tests gave no evidence of any such slippage under any conditions of loading.

Features of design

To adequately distribute concentrated loads in the completed deck, edges of the precast slabs were made thinner than the central portion. That is, the upper surface of the slab sloped downward toward the sides, thus thickening the depth of the cast-in-place portion where there would be need for additional strength across the joints between slabs. By putting additional steel in this thickened area of the top portion of the deck, especially bars across the joints, the deck has what is, in effect, a rib or beam along the joint between precast slabs.

This joint was designed to leave an open space of ⅝ in. between slabs. In practice this worked out to be just right. The slabs fitted together well and inspection from below after pouring showed that the concrete, which was placed with a 4-in. slump, did not come through the joints.

A design feature that contributed much to the integral construction of the finished deck is the provision for bonding between precast slabs, caps and poured portion of the deck. Steel bars projecting upward from the top of the caps were bent down into the space between the ends of adjoining slabs. The slabs were cast of such a length that they projected over the rim of the cap about 3 in. into the space over a depressed central section of the cap. Thus, when the mono-

lithic concrete was placed the pour not only covered the surface of the individual slabs, but extended continuously across the joints, filled in the depressed portion of the cap itself, and bonded together the reinforcing of the poured slab with that projecting from precast slabs and caps.

The ends of each cap were bonded, both by overlapping reinforcing bars, and by the monolithic pour of the substructure, with longitudinal marginal beams running along the edge of the wharf and serving as the outer member of the deck supporting the coil springs which take the thrust from the fender piles. The top of the deck extends about 2 ft. beyond the outer edge of this marginal beam. This projection is in the form of a cantilever overhang, whose reinforcing is integral with the steel in the beam itself.

To provide for maximum bonding between concrete of the final deck pour with that in the caps and in the marginal beams, shear blocks, consisting of precast 8x8x4-in. concrete keys were embedded in the upper surface of caps and marginal beams. These were set at such a level that they would be about half below and half above the surface on which the deck pour was placed. These shear keys are expected to increase resistance to any possible cleavage or slippage along the plane between the two layers of concrete.

For the open pipeway and large mooring dock a type of construction was used similar in some respects to that just described but making a different combination of precast and monolithic members. The sequence of deck assembly there started with girts bolted around the pile tops to support a precast box that served as a form for the cast-in-place concrete cap.

Methods of construction

The precast portions of the deck were made in the casting yard at Petaluma, whence they were brought

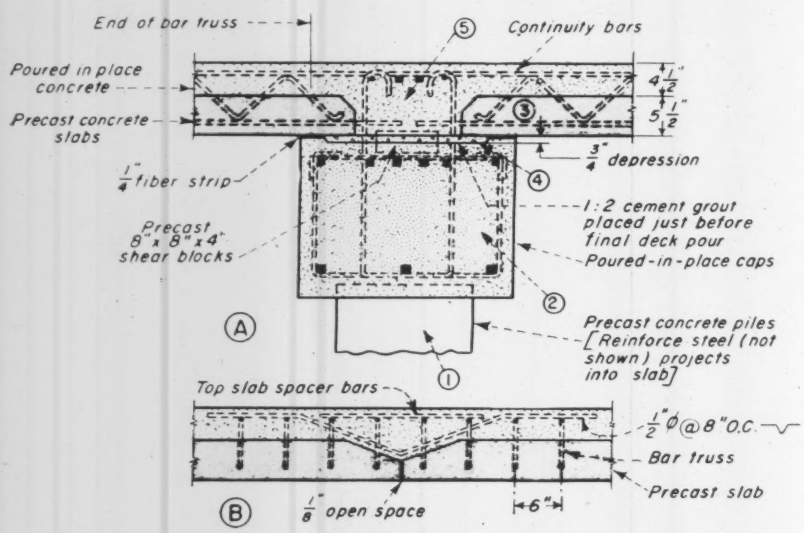

Fig. 3. (A) Section through wharf deck showing scheme for bonding caps with precast and cast-in-place deck members. (B) Section transverse to joint between precast slabs. The sloping slab edges thicken and strengthen cast-in-place portion over the joint. Numbers indicate the sequence of operations.

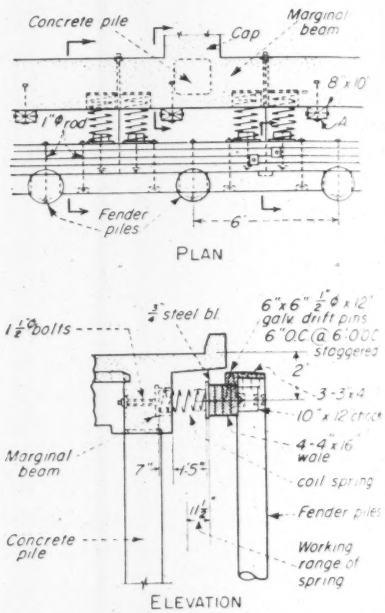

Fig. 5. Details of coil spring mounting between marginal beam and fender piles.

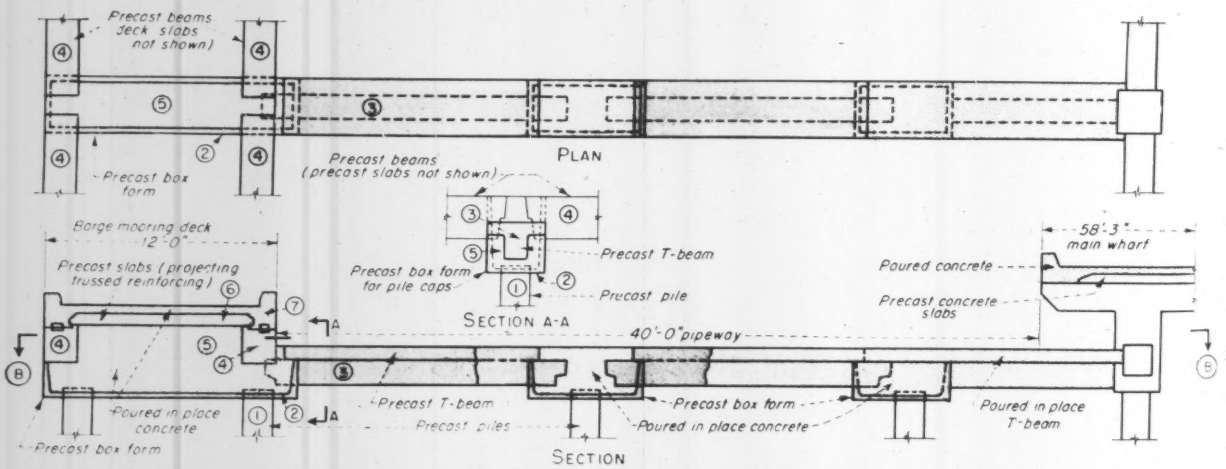

Fig. 4. Schematic sequence of construction in assembling precast and cast-in-place parts of pipeway and mooring dock.

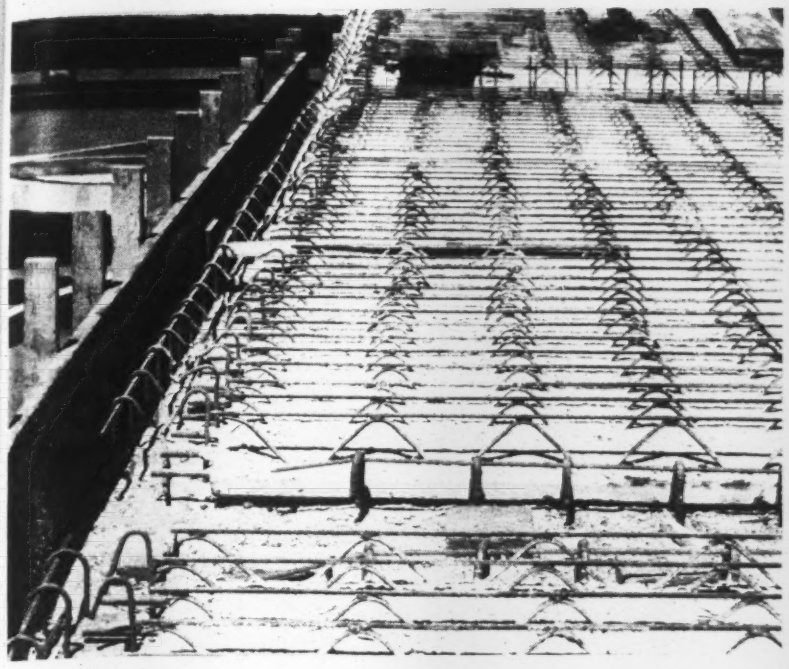

Fig. 5. Precast slab portion of wharf deck in place. Additional steel will be laid across the trusses before pouring upper part of the deck.

to the job on barges. Floating equipment was used for placing the slabs and for delivery of concrete mixed on the barge. The precast slabs that made up the lower portion of the deck were placed, at times, at the rate of 80 slabs per 8-hr. shift.

The poured portion of the deck was placed with a ½-cu.yd. bucket, and proceeded at the rate of about 5,000 sq.ft. of deck surface per 8-hr. shift. The pouring was scheduled so that each portion of the work could be completed in a continuous pour. Only one expansion joint was used in the wharf deck, located near the center.

This method of placing the deck slabs made it a simple matter to provide for manholes and other specials in the deck surface. A manhole ring, for example, would be placed in forms for the proper deck slab in the casting yard and usually welded to adjoining reinforcing steel. In addition to the lower half of the thickness as poured in the standard slab, in a manhole special the area around the manhole ring was brought up to finished deck level, thus leaving for final pouring on the job only a width around the four sides just sufficient to bond this special slab into the deck proper. This plan simplified the pouring schedule by making it unnecessary to take time on the wharf construction either to accurately adjust the manhole or to make careful embedment of concrete around it.

As in the causeway portion of this project, an admixture was used in the precast deck slabs to minimize the penetration of salt water into concrete covering reinforcing steel on the underside of the deck. Impregnated fiberboard strips were placed on the edges of the caps and marginal beam so that in landing the precast slabs there would be assurance of uniform bearing and well distributed load.

Provision for electrical service on the wharf was made by a plan which took full advantage of the casting yard. First a 2x2-ft. duct or open trough was cast, designed to be attached to the underside of the deck just inside the marginal beam. In this trough were placed the lengths of non-metallic conduit and concrete was then poured around them to fill the space between. At 300-ft. intervals it was necessary to provide manholes to make these utility ducts accessible. These manholes were made of precast concrete boxes usually 9½x 10½ ft. in plan and 7 ft. deep, likewise attached below the deck surface.

Fender springs were made of 1¼-in. spring steel bars, coiled into eight turns to form square-ended cylinders 12 in. in diameter and 2 ft. long. They were designed to withstand a horizontal thrust of 10,000 lb. each (3,000 lb. per linear foot of fender line) with a 12-in. compression. The springs were galvanized for protection against salt air and the galvanizing was applied by the electrolytic process to avoid any effect on temper of the steel.

Engineering on the project is handled by Austin W. Earl. Swinnerton and Walberg Co. and Ben C. Gerwick, Inc. are contractors. A complete statement of personnel with reference to owners, contractors and designers is given in preceding article (*ENR* Nov. 28, 1946, vol. p. 710).

Diversions of Highway Taxes

State highway user imposts diverted in 1946 to non-highway purposes were $94,579,000 according to recently released figures of the Public Roads Administration. Actually, according to the National Highway Users Conference, non-highway use of highway user revenues was $36,399,000 greater because the PRA offset that sum against appropriations for highways from state funds.

Proceeds of the 1946 highway user tax dollar were spent 56 c. for construction, maintenance and administration of state highways; 11 c. for state highway police, safety and service of state highway bonds; 27 c. for local roads and streets; and 6 c. for non-highway connected purposes.

Leading the list of diverters was Rhode Island which diverted 47 percent of net funds distributed. Other states diverting over 15 percent were Florida (36 percent), Louisiana (25 percent), Texas (21 percent), Georgia and Nebraska (17 percent), Tennessee (16 percent). Largest in dollar amount of diversion was Texas with $19,442,000 which was followed closely by Florida with $17,998,000.

The 1946 diversions reported by PRA represent a continued downward trend in the use of highway user taxes for non-highway purposes. However, since 1924 diversions aggregate the tremendous sum of $2,416,136,000.

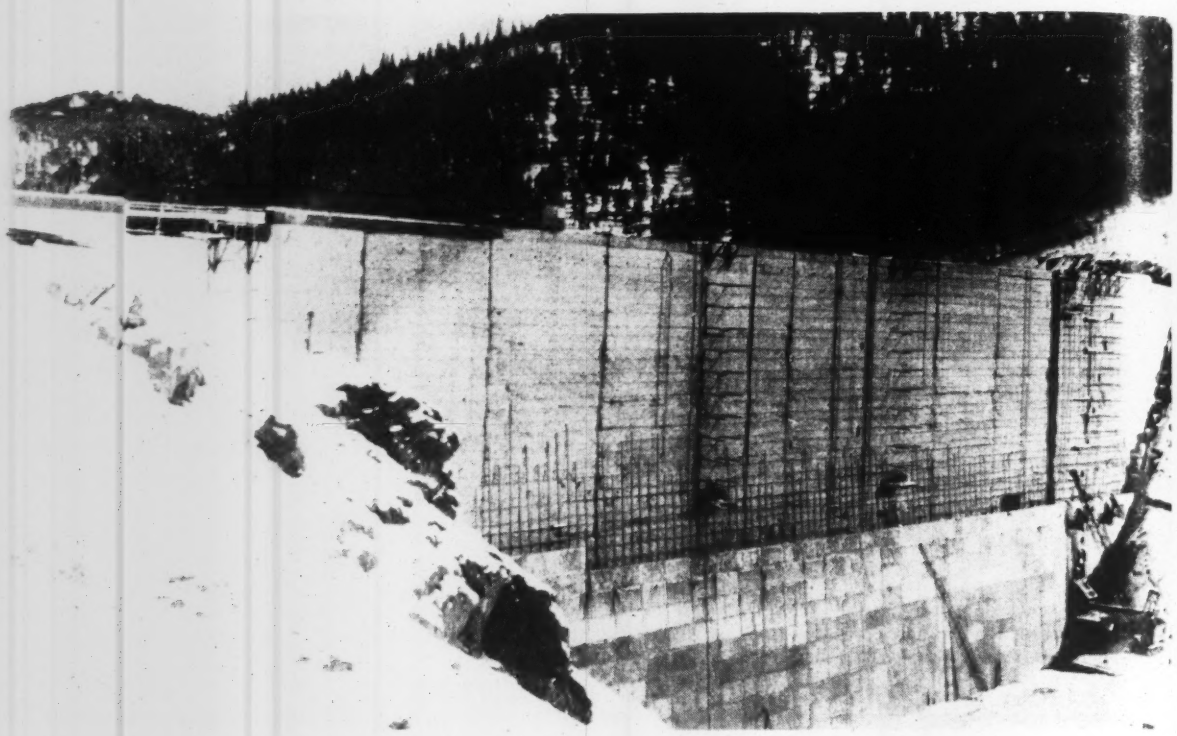

Fig. 1. Precast slabs of the upstream wall-form of Barker Dam are here partly in place. More slabs are being placed by the crane on the top of the dam; crane in lower right is dumping gravel from skips behind the wall-form.

Dam Refaced With Precast Concrete

***Contents in Brief**—When frost damage to the concrete of Barker Dam near Boulder, Colo., became serious the rather thin gravity section was thickened and a new upstream face was provided. This was done by setting up a wall of precast concrete slabs to serve as a form, welding projecting dowels to steel embedded in the upstream face of the dam and filling the intervening space with densely packed aggregate. The final step was a grouting operation of unusual scope and speed to complete the bonding of old and new portions of the structure while the dam was under nearly full reservoir load.*

AN INNOVATION in the method of rehabilitating a major dam was worked out in the recently completed refacing of Barker Dam, built in 1909-10 about 17 miles from Boulder, Colo., to store water for hydroelectric plants of the Public Service Company of Colorado. In recent years it has been observed that the upstream face of this dam was being disintegrated by frost action. This is understandable from the fact that the site is at El. 8200 and as a rule the reservoir is drawn down in late fall, leaving the full 175-ft. height of the dam exposed to the elements during the coldest weather. In some places, such as construction joints, it was found that the original concrete had been damaged by frost to a depth of 3 ft. However, average depth of frost damage over the entire face of the dam was about 5 in.

While the frost damage brought to a focus the need for repairs, this was not the only defect to be remedied. In addition to having a thinner section than would now be considered conservative, the original dam was built without foundation grouting and the fact that there was considerable percolation beneath the structure indicated that strong uplift pressure was developing beneath the dam.

In searching for the best means of strengthening the dam and providing it with protection against frost action, favorable consideration was given from the outset to a method of placing the aggregate separately, as a dry mix, and then forcing in grout to unify the mass, in other words, the method known as "Prepakt". This method was finally selected for three reasons, namely:

(1) This method offered a means of completing the job in the minimum time. This was important because the value of a season's runoff was too great to be wasted and the work had to be completed in the period between low reservoir level in the fall and high water of the following spring.

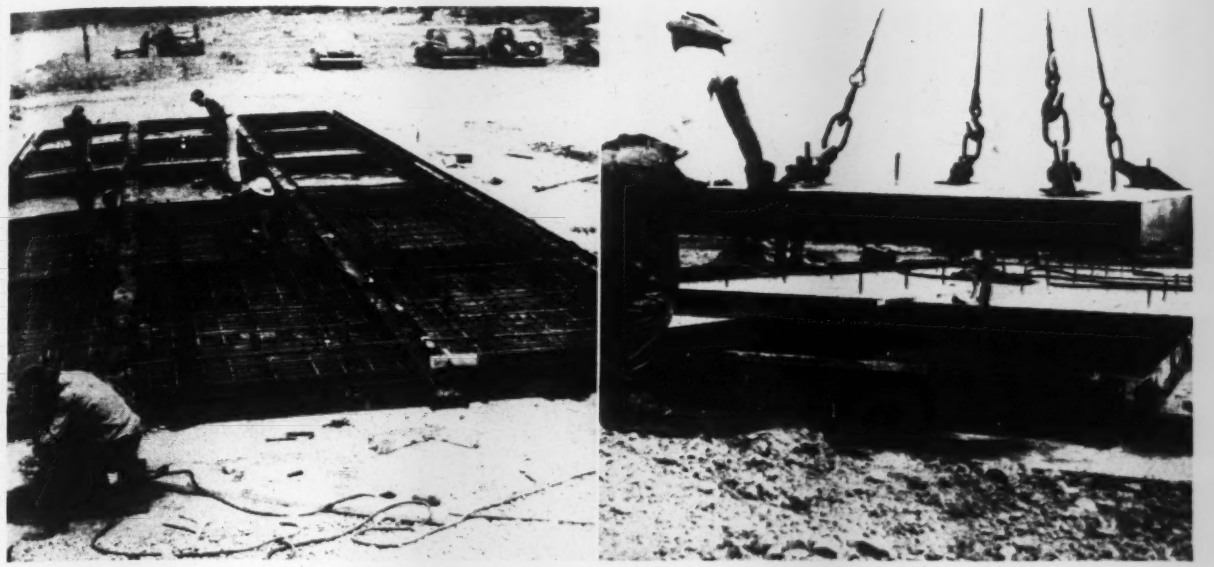

Fig. 2. In the slab casting yard, reinforcing cages were suspended from angles resting on the steel H-beams that surround each slab (left). After casting the slabs, hydraulic pressure was used to free each slab by breaking the vacuum bond. Note jet of water under the slab still flowing.

(2) It was desired to place the new face at the lowest possible temperature (above freezing) in order to minimize shrinkage. Under the program followed it was possible to pump grout at 58 deg. temperature into the ready-placed aggregate at reservoir water temperature, which was 43 deg. Thus, by the method used, concrete was in place at temperatures some 40 deg. lower than would have been possible with ordinary concreting methods.

(3) A final and important advantage of the method chosen was that the addition to the dam was bonded to the old structure while the latter was under almost full load. Thus there would be a minimum of cracking due to temperature changes and stress.

Although this method of construction has been used on various other types of work for a long time and has been applied on the downstream faces of dams in United States and Canada, it is believed that this is the first time it has been employed on such a large scale on the upstream face of a major dam.

Deep foundation grouting

Work began in the summer and fall of 1946, following the water level down as the reservoir was lowered on its normal service schedule. The first operations were excavating for the footing of the new concrete along the upstream face of the dam. Step footings were put in for the wall to be built of precast concrete slabs, the foundation was grouted, and drainage holes were put down. In this work the foundation conditions were found to be much worse than had been expected. There were mud seams and cavities which necessitated going 20 ft. below the base of the old dam in a few places to find suitable foundation. In general the new foundation went about 10 ft. below the old concrete.

Foundation grout holes, spaced generally at about 10-ft. centers, were put down until well into solid rock and usually finished with minimum diameters of $1\frac{5}{16}$ in. The usual depth of these holes was about 60 ft.; the maximum went to about 100 ft. Beginning with low grouting pressures, the range was up to a maximum of 200 psi.

In the total of about 200 holes, some 7,000 sacks of cement was used. In mixing the cement with water to form the grout slurry, one part of a finely divided, active siliceous material was added to each two parts of cement. As this material consists of finer particles than the cement, it was expected to prevent flocculation and to make the cement remain in suspension longer. There was also an admixture of 1 percent of the cement, by weight, of a fluidifying or "intrusion agent" to increase the fluidity of the mix and to prolong suspension.

Drainage holes were driven on the downstream side of the grout curtain and were put down to a depth of 10 ft. less than the nearby grout holes. These drainage holes, which were all vented to a main drain and thence through the dam, are expected to prevent uplift by relieving the pressure that was in evidence before repair began.

Work from water

On the upstream face of the dam preparatory work was also done as the water level sank lower. For the most part this was done from floating scaffolds where men worked with compressed air gads, chipping off the frost-damaged concrete and placing steel bars in holes drilled into the face of the dam. These bars were to be welded later to dowels projecting from the precast slabs. This work took off an average of 5 in. of concrete over the entire face of the dam but at each point was carried down into sound concrete. The holes for the bars were drilled 36 in. into the sound concrete, and were spaced at intervals to correspond with the dowels projecting from the slabs. Lengths of these bars was in accord with the thickness of the new facing

desired at the different heights. This thickness ranged from a maximum of about 9 ft. at the bottom to a minimum of 3 ft. at the crest of the dam.

Drainage tunnel

After live storage in the reservoir had been drained out there remained a depth of about 40 ft. of dead storage which had to be removed by a tunnel specially driven through the dam. This tunnel, 4x6 ft. in section, was driven from the downstream face and when it had reached a point very close to the upstream face the remaining concrete was shot out into the reservoir by a blast that opened the upstream entrance to the new outlet. The 30 to 40 ft. of silt depth above the upper end of the tunnel was slow to move out and had to be aided by clamshell and other means. However, this was finally accomplished, the dead storage was all removed and complete clearance of the upstream lower edge of the dam was effected.

In blasting the tunnel the dynamite charges were kept down to a minimum to avoid undesirable damage to the concrete. Also gages were used to determine the stress in the concrete resultant from blasting. Close to the charges these stresses ranged up to about 5,000 psi. but as they died out very quickly they were not considered damaging even to the old and relatively porous cyclopean masonry in the old dam. Confirmation of this belief was found in the fact that these shocks did not develop any cracks in the concrete.

Precasting the slabs

The most economical size for the precast slabs, of which the upstream form-wall was built, was found to be 6 ft. 8 in. wide by 12 ft. long and 8 in. thick. These slabs weighed 4 tons each. About 1,000 of them were needed in addition to a considerable number of specials designed for certain locations. A casting yard was selected at a point about 3 miles from the dam where concrete paving could be laid for the forms and where there would be ample space for curing the slabs, which could be lifted from the forms about 24 hours after casting.

Forms for the slabs were made by laying steel H-beams on the paved casting area arranged to outline the

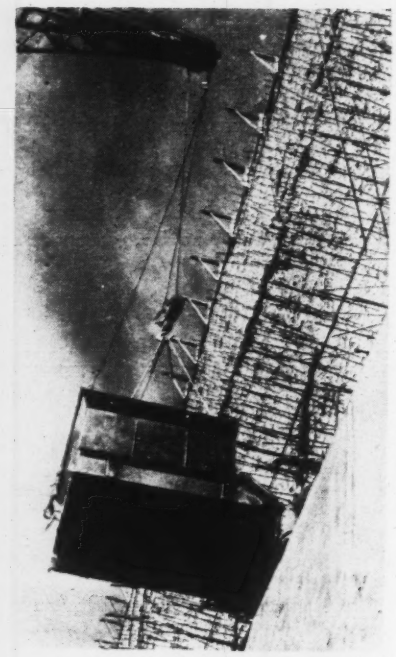

Fig. 3. Dumping gravel from a 3-cu. yd. skip into the space between the wall-form and the face of the dam.

four edges of each slab. Across each of the spaces so formed, on the 6-ft. 8-in. span, were laid steel angles from which to suspend the reinforcing cage that would be embedded in the concrete of each slab. These cages, in addition to the steel required for adequate reinforcement in the slab, were provided with six 1-in. dowels projecting 8 in. from the inner face of the finished slab. The embedded ends of these dowels were wrapped around and welded to principal members of the reinforcing frame and hence were convenient "handles" by means of which to lift the assembled cage and, later, the concrete slab itself.

During placement of the concrete the reinforcing cage was suspended in the form from three angles, a pair of the projecting dowels being fastened to each angle. The method of doing this was to bring a cage ready for the slab and rest it on the concrete paving. The angles would then be lowered over the dowels which passed through appropriately spaced holes in the angles. With the angles over marks on the H-beams, the cage would be raised the desired distance above the pavement and suspended there by a collar and set screw on each dowel where it passed through the angle.

After slabs had remained in the forms about one day, they were picked up by the yard crane and placed in the curing area where they were kept under water spray for 14 days. The same yard crane also loaded them on flat bed trucks for delivery to the dam. Before slabs were cast, the casting floor was oiled to prevent any bonding of old and new concrete. Despite this, lifting off a 4-ton slab at first required an upward pull of 17 tons to break the "vacuum bond." This was remedied by placing a 12-in. steel plate in the casting floor, set flush with the surface and covering the end of a water pipe. When the time came to lift the slab, water pressure under the plate was effective in releasing the slab.

Building the wall of precast slabs

On arrival in the bottom of the reservoir near the dam, the slabs were picked up by a crane and set in place on the prepared foundation. As each slab was lifted off the trailer an inspector placed a target on its upper edge and this was lined in by a transitman until it was satisfactorily in position. The lower edge of each slab rested temporarily on steel shims which served the dual purpose of bringing it to exact level and also leaving a narrow space between the edges of adjoining slabs into which grout could be forced as each tier of slabs was completed. The width of these joints between slabs was generally $\frac{1}{2}$ to $\frac{3}{4}$ in.

Welding slab dowels to bars projecting from the dam was begun immediately after the placement of each slab. A gasoline torch was first used to heat the projecting dowels so they could be bent into position alongside the bars from the dam. A clamp was then used to temporarily hold the two pieces of steel together until the weld had been made.

Cranes working from the reservoir bottom placed slabs as far up the face of the dam as they could reach with 100-ft. booms. Thereafter the work was carried on by a crane on the crest of the dam. Despite the high velocity of wind down the canyon, which it had been thought might make this work difficult, the crew became so adept that slabs were set in place exactly with great speed. The record for a single crane was 27 slabs set in an 8-hr. shift.

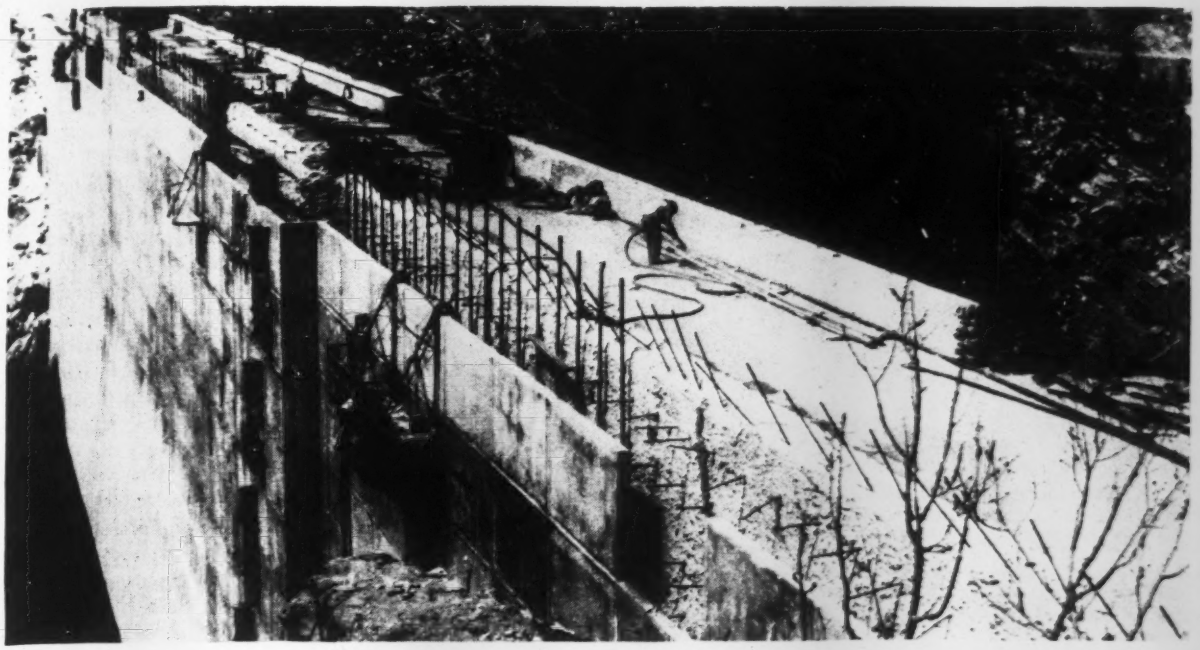

Fig. 4. The wall-form is here completed except for one more tier of slabs. Note grout pipes that are spaced on 4-ft. centers. Scaffolds moved on rollers riding on the upper edge of the wall-form.

A novel method developed for grouting the joints between these slabs worked out with great success. This consisted of placing muslin strips over the open joints to prevent escape of the grout while it was being forced in between the slab edges. Duco cement was brushed over the edges of the slabs along each joint and a 3-in. width of muslin (50 threads to the inch) spanning the joint was then pressed into this cement. To insure bond between the cement and the muslin, the roll of cloth was dipped in acetone just before application. The acetone, being a solvent for the cement, assured bond even if the cement had already hardened.

This light muslin strip, contrary to what might be thought, was strong enough to remain intact while sufficient grout pressure was used to completely fill the joints. Not a single muslin strip was "blown" despite the fact that sometimes a double tier of slabs was grouted, thus putting a hydrostatic head of more than 13 ft. on the lower end of the joint. This success with a cemented-cloth strip is believed to be partly due to the fact that the muslin mesh would allow water to pass through it while it retained the cement to effectively clog the narrow opening of the joint.

Application methods were such as to make the strips continuous on vertical and horizontal joints. The grouting was done through a very small grouting nozzle which punctured the muslin strip at any desired point. The tip was a tube small enough to be thrust into the joint while a rubber washer prevented grout from flowing back around the outside of the nozzle. The placing of the muslin strips and the grouting of joints between precast slabs was done from travelers moving on rollers that rode along the upper edge of a tier of slabs.

Preparations for grouting

Only coarse aggregate was used in filling the space between the precast wall-form and the face of the dam. That is, aggregate in the nominal screen sizes from $\frac{3}{8}$ in. to $4\frac{1}{2}$in. This material, with no fines whatever, was put in progressively after each successive tier of precast slabs had been grouted in place and the projecting steel welded. Thus the crew of workmen were through on the floor of the reservoir and were ready to move out and allow runoff to be stored as soon as the cranes had finished working as high up as they could reach from the reservoir bottom. From that stage of the work until completion of the job all operations were conducted from the top of the dam.

The dry aggregate was brought to the dam in dump trucks that discharged into skips. At first these skips received their load on the reservoir bottom and were lifted by cranes to dumping position. Later, when the wall reached too great a height for this, delivery was to skips on top of the dam whence they were lowered to dumping position.

For grouting operations careful provision was made to insure adequate capacity in the mixing plant so that no emergency would be likely to curtail output once the final, continuous grouting operation was started. At one end of the dam crest a grout-mixing plant was erected and equipped with two 1-cu.yd. dual drum grout mixers, one of which was a spare. All parts of the plant from bunker to delivery lines were designed with spare capacity for more than the 600 cu.yd. of grout per 24 hr., which was the maximum rate of grout delivery contemplated.

Ingredients of the grout itself consisted of cement, sand, a finely divided siliceous material and a very small percentage of a fluidifying agent. The proportions, for each sack of cement were: 100 lb. of the finely divided siliceous material, 300 lb.

Fig. 5. The top of the dam was a busy place during the grouting operation. Grout pumps, charged from a circulating grout pipe, discharged through hoses (left) that were thrust down in the vertical grout pipes.

of sand and 3 lb. of the fluidifying agent. The sand was of a size that would mostly pass through a No. 16 screen and had a fineness modulus of about two.

The grouting operation

With enough water to permit of ready pumping as a liquid, this mixture was circulated through a pipe loop that started at the mixing plant and encircled the crest of the dam. This loop began with a pipe 3 in. in diameter; diameters successively decreased as the several grout pumping stations were passed until the return line to the mixing plant was only 1½ in. in diameter. Fifteen grout pumps were located on the crest of the dam and at each pump a valve from the grout delivery line permitted the operator to divert the desired amount of flow to the hopper at his pump. The complete loop was desirable to permit of testing out the line, keeping the flow moving regardless of pump requirements and for clearing the line with water in any emergency.

Several types of grout pumps were used but only light duty was required because delivery lines went straight down and the static head at the lower end of the work was about 175 ft.

The grout pipes were 2 in. in diameter and had been placed, in vertical positions, as the aggregate was put in. They were located on 4-ft. centers, although the plan was to use only alternate pipes for grouting. The intervening pipes were for sounding the level of water and of grout and also for emergency service as grout pipes in case any of the grout lines became clogged. These pipes had slots 8 in. long and ¼ in. wide at 3-ft. intervals. The grout was delivered through rubber hoses whose outside diameter was slightly less than the inside diameter of the grout pipes. The hoses were thrust down the full depth before grouting began and were withdrawn, a little at a time, as grouting progressed.

The grouting operation was not started until the water level in the reservoir had risen nearly to the crest of the dam. The idea of completing the grouting in one continuous operation was then successfully carried out. Grouting started on June 2, 1947, and ten days later the full depth of 170 ft. had been grouted by the delivery of some 4,200 cu.yd. of the grout slurry.

There was about 13,000 cu.yd. of aggregate in place between the precast slab wall and the face of the old dam. This aggregate was made into concrete by the grouting operation which completed from 1,300 to 2,000 cu.yd. of the work per day of three 8-hr. shifts. Normally about 90 grout holes were operated simultaneously.

As the water filling the reservoir was at a temperature of 43 deg. F. and as this water filled the interstices between the coarse gravel particles, naturally the gravel was brought to the same temperature. The grout was delivered at an average temperature of 58 deg. F. The average maximum temperature of the concrete, during the hardening period was only 67 deg. F., about 10 deg. F. lower than would have been possible with ordinary concrete placed in the usual manner.

Part of the grouting program was to carefully watch the temperature in the water just above the mass of aggregate being grouted. Whenever this rose 5 deg. above reservoir-water temperature, water was circulated by pumping so as to reduce the temperature to that of reservoir water. This proved to be a very simple and satisfactory means of maintaining low temperature in the concrete.

Progress of the grouting at a much more rapid rate than had been expected was made possible by use of information provided by 50 Carlson strain meters that had been placed inside steel tubes attached to anchor bars distributed through the aggregate. From the observed strains, pressures against the precast slab forms could be quickly calculated. These meters showed that despite the relatively low temperatures and the time required for setting, the grout did not behave as a true liquid and the pressures shown by the meters were less than half as much as anticipated. Near the bottom of the coarse aggregate, where the grout was under the maximum static head, the addition of the grout did not increase the pressure against the precast slabs by any appreciable degree. After completion of the grouting it was calculated that the grout was the equivalent of about 3 sacks of cement per cubic yard, that is, it constituted about 33 percent of the combined volume of aggregate and grout filling the space between the old face of the dam and the precast slab wall.

Reconstruction of Barker Dam was carried out under the immediate supervision of W. T. Neelands, resident engineer for the Public Service Company of Colorado. E. Clinton Jansen is chief hydraulic engineer and Raymond E. Davis is consulting engineer for the company. The reconstruction was under contract to the Prepakt Concrete Co., Cleveland, Ohio, for whom John Hofer was general superintendent.

RESEARCH LABORATORIES OF THE BUREAU OF RECLAMATION — PART V

Operation and Maintenance Studies

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***Contents in Brief**—This is the fifth in a series of articles outlining the objectives and scope of engineering research conducted by the Bureau of Reclamation. This installment relates how investigations are initiated to cope with unexpected difficulties that sometimes occur after a structure goes into service. It also describes the manner in which research methods are used to record performance and thus open the way to modification of future designs.*

ENGINEERING PROBLEMS do not cease to arise when a structure is completed or when a project goes into operation. Unforeseen developments may present themselves after operation begins. Enlargement or modification of the structure may be required to increase its usefulness or to accomplish new objectives: and sooner or later, restorative measures may be required to repair deterioration due to ordinary wear and tear.

The central engineering laboratories serve the Bureau of Reclamation in determining and evaluating methods and materials best suited for rehabilitation requirements. This is accomplished through hydraulic studies of laboratory models, field and laboratory geological investigations, and developments in engineering materials and methods. In addition, by carefully observing and recording the performance of structures, ideas are gained and tested in the laboratories which often lead to improved design.

Spillways redesigned

Hydraulic investigation leading to improved design and more economical operation of completed works are conducted both in the laboratory and in the field. An example of this application is the model studies in connection with certain features of Hoover Dam. In 1942 it became advisable to repair erosion damage downstream from the two outlet tunnels and the two spillway tunnels and to alter the design so that future channel repairs would be infrequent or unnecessary. A model of the river channel showed that there was not sufficient area in the river to dissipate the energy as originally contemplated.

Studies of redesign by hydraulic models resulted finally in skew deflectors being installed in the two outlet tunnels. These deflectors lift the jets of water and direct them toward the center of the river away from the canyon walls. Two undesirable conditions, the destructive whirlpool in the center of the river and the action of the jets against the canyon walls, were thereby alleviated.

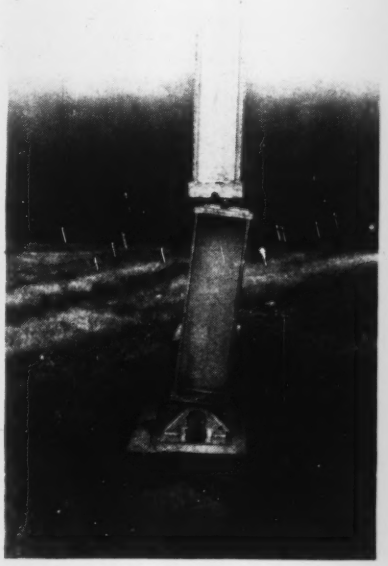


Fig. 1. Displaced support at Malheur River siphon caused by swelling of bentonite shales in the foundation.

The Nevada spillway tunnel was extended 400 ft. downstream on a curve to pass a hazardous slide area. Deflectors were also placed in the ends of this and the Arizona spillway tunnels. In this way the high-velocity jets were diverted upward and outward toward the center of the river where they would strike the river with relatively small disturbance. Effective design of these alterations without the aid of model studies would have been impossible. Millions of dollars could have been spent unnecessarily either in maintenance or trial-and-error alterations in the field. The model studies cost about $5,000.

Another example of the application of laboratory techniques to an actual operating problem is the redesign of the Sunnyside Canal on the Yakima project in the state of Washington. The original designed capacity of this canal was much less than the current demand. The gradual increase of flow and consequent increase in channel velocity resulted in scour and necessitated the construction of check drops. The scour downstream from these drops required costly maintenance.

The first step in the redesign was to build and operate a laboratory model of the original structure to determine the similarity of behavior between the prototype and the model. After this similarity had been established, the causes of the scour pattern were studied and features introduced into the original structure to remove these causes without excessive costs. These studies, extending intermittently over some six months, produced a design in which the scour was eliminated and the cost of modifi-

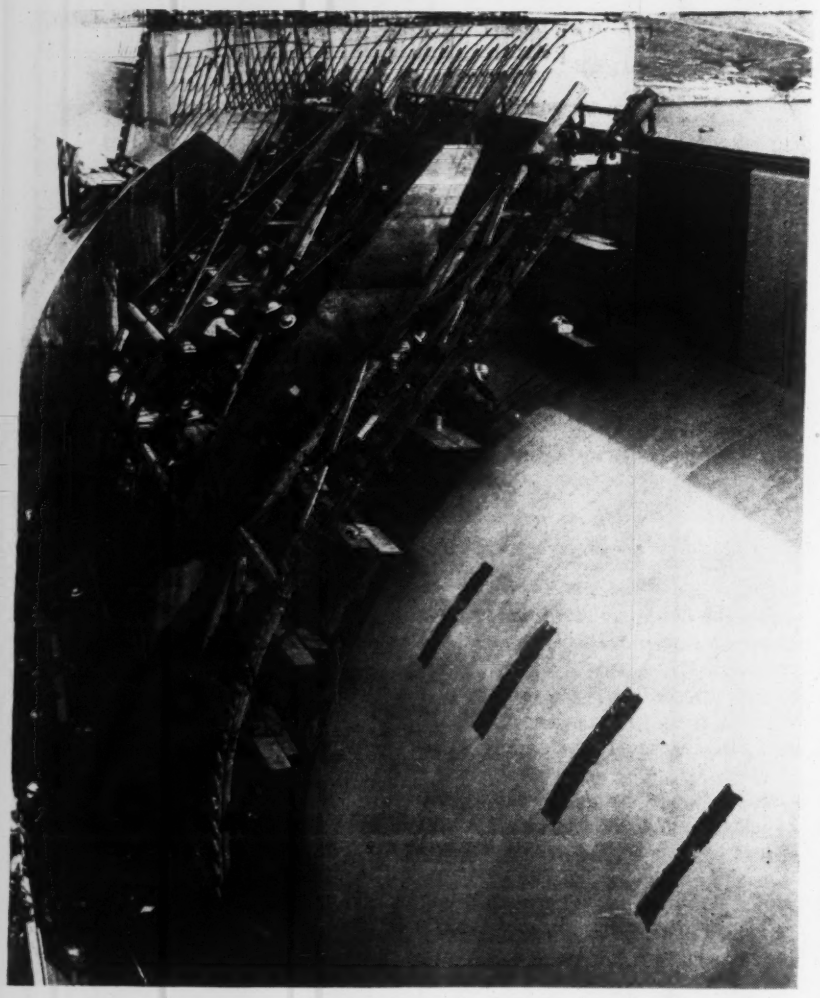


Fig. 2. Painting operations on a 135-28-ft. drum-gate at Grand Coulee Dam. the dam has eleven of these gates. Long life in the protective coating is essential if maintenance painting costs are to be kept at a reasonable level.

cation of the existing structure was a minimum.

Other instances in which operating problems have been minimized or eliminated by model studies are the redesign of the spillways for the Mormon Flat, Horse Mesa, Stewart Mountain, and Elephant Butte dams.

Utilizing geological information

The services of the geologist and the allied petrographic and earth-materials testing facilities are being used to an increasing extent in dealing with the miscellany of unpredictable and unforeseen problems that arise during the period of operation and maintenance of a structure. In problems such as anomalous foundation settlement, abnormal deterioration of concrete or unexpected water seepage, the geologic conditions and characteristics of the materials commonly are of paramount importance.

Foundation rocks and materials may contain clays which, when wetted expand to many times their original volume and exert disruptive forces on the structure. An illustration of this type of problem is the Malheur River Siphon, a million-dollar structure in Oregon which comprises nearly 22,000 ft. of 30-in. steel pipe. Within three years after its construction the structure showed serious movements, apparently as a result of displacements in the foundation.

Samples of the foundation were obtained from the field, and microscopic, microchemical, and physical tests disclosed that the foundation was composed of bentonitic shale which swelled when wet with such force as to lift the siphon. Geological investigations in the field and laboratory demonstrated that the swelling of the shales was associated with a rise of the watertable and that the water was supplied by seepage from a nearby unlined canal. The laboratory devised an impervious asphaltic lining for the portion of the canal which was leaking, and no further damage has occurred. Expensive repairs were thus avoided and the possible failure of the siphon which supplies necessary irrigation water to a large area of land was avoided.

Concrete repair work

Restoration of damaged or deteriorated concrete portions of structures in service is often unsatisfactory due to poor bonding and shrinkage. These causes of failure or poor performance of repaired structures have been greatly minimized by the development in the laboratories of special mixes, materials and techniques for such work. Thorough removal of all possibly affected material, and clean, sandblasted, damp, pre-wetted surfaces, have been found essential to secure serviceable repairs.

Settlement shrinkage prior to the final set of concrete in replacements has often resulted in leaking and insecure repairs. This has been eliminated by the use of squeeze-type forms, pressure caps in placing shafts, pre-mixing of concrete, and in some cases by the use of minute amounts of aluminum powder added to the mix. The function of the aluminum is to generate enough gas to cause the concrete to swell slightly, offsetting settlement and tightly filling the intended space. Better bond with old surfaces is also obtained in this manner.

Another new procedure for concrete repair work is Prepakt concrete, which has received considerable study and development in the laboratories. Aggregate is first packed in the forms and then the mass is solidified by intruding a special sand-cement grout into the voids. This appears to have advantages as compared to ordinary concrete methods for certain types of work, such as the patching of irregular areas on structures after chipping away the disintegrated concrete, the rehabilitation and refacing of disintegrated masonry and concrete

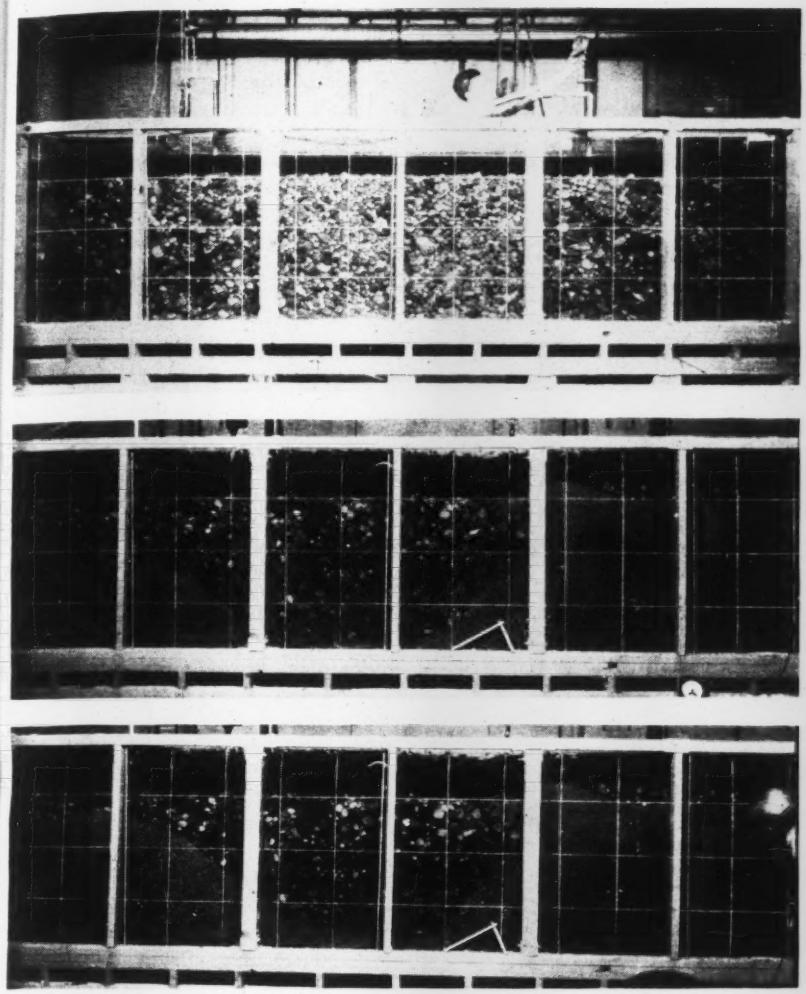


Fig. 3. Studies on the Prepakt concrete technique in which aggregate is first packed into forms and then solidified by injecting a special sand-cement grout. The top view shows the packed aggregate and grout pipes before the test. The middle and lower photos show progressive advance of grout.

structures, filling of cavities, galleries, and conduits, and for placing concrete under water.

Some of the advantages found for the Prepakt method are less shrinkage upon drying, excellent bonding with old concrete or rock, adaptability to rapid construction conditions, greatly simplified equipment requirements, extreme flexibility, and comparable cost to conventional type concrete. This method of repair was used to replace concrete in the Arizona spillway tunnel at Hoover Dam which had been damaged by cavitation when the spillway was first operated.

Spillway erosion checked

At the time Grand Coulee Dam was built, it was impossible to pass the river flow in a manner that would avoid eddy currents and backwash in the spillway bucket. The immediate result was serious erosion of the bucket by the abrasive action of gravel and boulders carried upstream into the bucket. Study of hydraulic models in the laboratory has demonstrated means of operating the gates in this and other spillways so that eddy currents destructive to the downstream features of the dams and tailraces are avoided. However, extensive repairs of the initial erosion at Grand Coulee will be necessary and the laboratories have assisted in formulating plans for doing this work, which will require operations to be carried out in turbulent water as much as 70 ft. below the surface.

For this purpose, a huge floating caisson 54 by 110 ft. in plan has been constructed to fit down on a 54-ft. length of the spillway bucket and make it possible to unwater and do all necessary work in that length of the bucket. Since explorations indicate irregular eroded patches from a few inches to several feet in depth at random on the surface of the bucket, it becomes no simple task to effect a seal at the bottom edges of the caisson. Consequently, Prepakt concrete has been studied under the cold underwater conditions of this application and results are favorable for a highly satisfactory seal by this means. Studies are also being made of the possibility of freezing the water in the cavities under the seal and keeping it frozen to serve as a filler under the seal while the caisson is unwatered.

Corrosion protective measures

Because of the large amount of continuously submerged and alternately submerged metalwork on bureau structures, the prevention of corrosion is very important. The application of protective coatings during construction is only the beginning. Maintenance painting soon becomes a considerable item in overall operating procedures. Studies in the laboratories to improve protective coatings and reduce operating expenses are therefore continuous.

Improvements in cold-applied coal-tar base coatings have already doubled their serviceable life. Special attention is now being devoted to plastics. Some of these are known to be practically impermeable and completely resistant to water and apparently need only a method for obtaining perfect bond to metal surfaces to provide the long-sought goal of permanent, effective protection.

Another promising means of preventing corrosion is an electrical method known as cathodic protection. It has been in successful use for some time by the petroleum industry for corrosion prevention on oil and gas pipelines, and is now being studied to determine its applicability to buried pipe and submerged metalwork in bureau construction. In practice, the electrical currents causing metal losses are checked by impressing an opposing direct current from an external source on the corroding metal area. As a result, corrosion can be stopped. This exter-

Fig. 5. Repairing cracks in a concrete canal lining with an air-operated mastic gun developed by the Bureau of Reclamation.

nally supplied current may be from a motor generator combination, a galvanic metal installation or a rectified alternating current source.

Cathodic protection is expected to be particularly valuable to operating projects from a dollars and cents standpoint, because where applicable, it can be installed on structures without the necessity of unwatering or removal of backfill as is required for painting. In addition, maintenance painting costs are eliminated.

Waterproofing and sealing

In some of the older concrete structures, the need for waterproofing has arisen. Methods and materials used in the past have not been completely satisfactory. Cement mortar is somewhat porous and subject to cracking. Bituminous materials are easily damaged by ice and driftwood. Corrosion-resistant metal facings are expensive, and stone facings do not insure watertightness.

The laboratories are presently investigating certain plastics and synthetic rubbers as waterproofing agents. Some of these look particularly promising because they have the necessary extensibility to bridge any hair-line cracks that develop in the concrete after the coating is applied. Their resilience will be advantageous in resisting abrasion, and the adherence to concrete appears to be very good. Field tests of selected products are planned for the near future, the site to be one of the older bureau concrete dams that is now showing some leakage.

A new crack and joint sealer, recently developed in the laboratories, has already been put to good use in maintenance work, as well as in new construction. This is a plasticized asphaltic material that is applied cold and shows good flexibility at low temperatures and exceptional adherence to concrete. It has been used very successfully for repairing cracks in concrete canal lining on Yakima project and for calking the horizontal joint between the high and low dam sections of Marshall Ford Dam.

Various methods of weed control

Another problem of considerable importance from a maintenance standpoint is the question of weed control, with particular emphasis on the control of the aquatic type. Aquatic weeds cause many operational problems as well as much expensive maintenance. They reduce the carrying capacity of canals, clog structures and drains, induce silt deposits, and cause overflowing of banks, which sometimes results in ditch breaks.

Field reports for 1946 indicate that the cost of mechanical removal of these growths ranges from $150 to $500 per mile of canal, depending on the capacity, and this procedure must be repeated frequently during the growing season. Using the best available chemical means for the removal of aquatic growth, the cost ranges from about $75 to $250 per mile of canal.

The Bureau of Reclamation has attacked the weed problem as a cooperative undertaking with the Bureau of Plant Industry of the Department of Agriculture. Three field stations have been set up by the Bureau of Plant Industry, at Phoenix, Ariz.; Boise, Idaho; and Prosser, Wash. These stations in addition to other investigations test under actual field conditions materials and methods resulting from the Denver laboratory researches.

Many chemicals studied

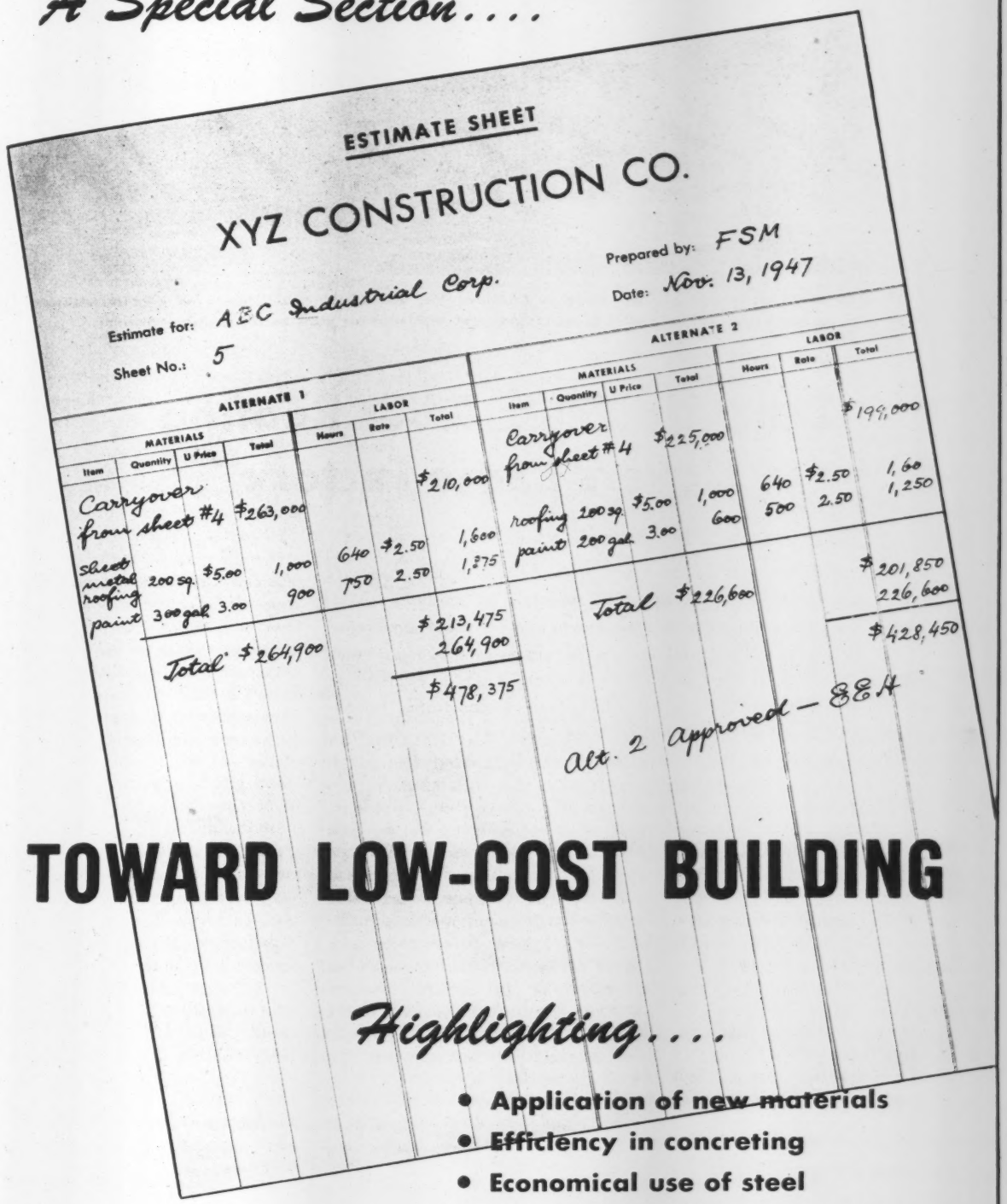
Weed control research is conducted in the Bureau's Chemical Laboratory to which has been assigned a plant physiologist by the Bureau of Plant Industry. In this laboratory, various chemicals are screened to ascertain their potential killing or herbicidal effect on aquatic weeds and to ascertain their toxicity on crop plants. Other studies include life history studies of aquatic weeds including propagation, the effect of shading and turbidity on growth, the effect of various treatments on root reserves, the physiological action of toxic chemical formulations, the influence of water temperature on treatments, the susceptibility to toxic materials at various stages of growth, and the best time of day and weather conditions most suitable for treatment. Chemical control of weed growth on ditch banks is also under investigation.

Less expensive and more toxic chemicals are urgently needed for the control of aquatic weeds. Several such materials show considerable promise in the laboratory at the present time. Some of the fractions of coal-tar distillates indicate definite toxicity in comparatively small amounts in the laboratory. Copper sulfate is also showing good results in waters which are low in carbonates.

The amount of money expended in adequate weed control will be returned many-fold in terms of increased crop yields, better crop quality, reduced expenditures for labor and machinery, and fewer acres of agricultural land lost to cultivation.

The final article in this series, which will be published in a forthcoming issue, will point to the potentialities of new developments uncovered by research.

A Special Section....



ESTIMATE SHEET

XYZ CONSTRUCTION CO.

Estimate for: ABC Industrial Corp.

Prepared by: FSM

Sheet No.: 5

Date: Nov. 13, 1947

ALTERNATE 1							ALTERNATE 2						
MATERIALS				LABOR			MATERIALS				LABOR		
Item	Quantity	U Price	Total	Hours	Rate	Total	Item	Quantity	U Price	Total	Hours	Rate	Total
Carryover from sheet #4			$263,000			$210,000	Carryover from sheet #4			$225,000			$199,000
Sheet metal roofing	200 sq.	$5.00	1,000	640	$2.50	1,600	roofing	200 sq.	$5.00	1,000	640	$2.50	1,60
paint	300 gal.	3.00	900	750	2.50	1,375	paint	200 gal.	3.00	600	500	2.50	1,250
						$213,475							$201,850
Total			$264,900			264,900	Total			$226,600			226,600
						$478,375							$428,450

alt. 2 approved — EEA

TOWARD LOW-COST BUILDING

Highlighting....

- **Application of new materials**
- **Efficiency in concreting**
- **Economical use of steel**
- **Mass-production techniques**

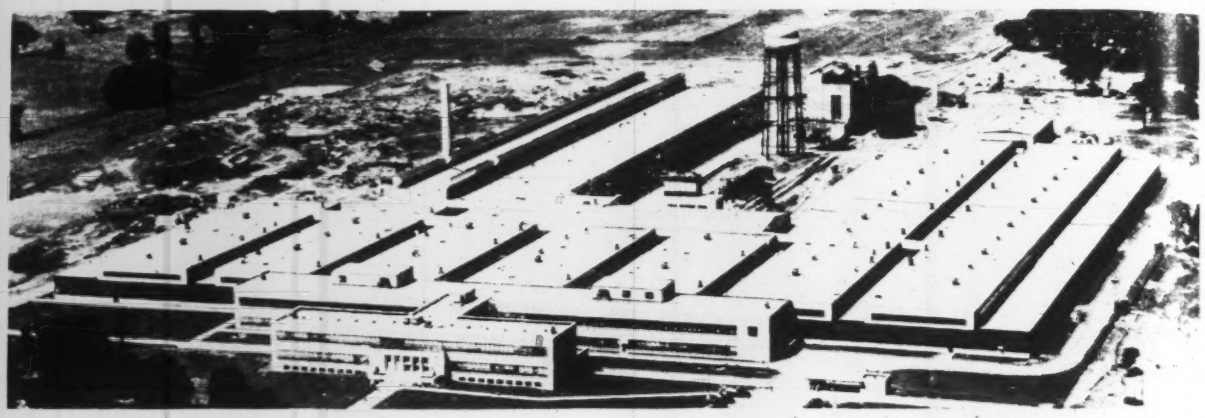


Fig. 1. A roof area of 15 acres on the new plant in Ohio for the New Departure Division of General Motors Corp. is covered with built-up roofing using three plies of glass-fiber mat with coal-tar pitch as the bonding medium.

Built-Up Glass-Fiber Roofing Covers Large Factory

***Contents in Brief**—Shortages of conventional materials during construction of a large plant for manufacture of ball bearings at Sandusky, Ohio, opened the door to adoption of alternate practices. The most significant innovation was use of glass-fiber mat instead of rag felt in built-up roofing to cover 15 acres of precast concrete tile deck. Both in application and in promise of serviceability, the new procedure demonstrated advantages over traditional practice. Other features, different from the ordinary, entered into the design and construction of the fully integrated plant.*

CONSTRUCTION of the recently completed "Western Manufacturing Plant" at Sandusky, Ohio, for the New Departure Division of General Motors Corp. brought forth several deviations from conventional practice to meet problems caused by lack of materials and skilled manpower. To a designer or building contractor, the most significant of these innovations was the successful use over an area of more than 500,000 sq. ft. of built-up roofing that incorporated three plies of glass-fiber mat in coal-tar pitch as a substitute for conventional four-ply felt construction. The glass-fiber roof demonstrated several advantages of great practical interest.

As another alternative, designed to circumvent a severe shortage of bricklayers in the area, walls to sill height on the manufacturing building were constructed of pneumatically placed sand concrete in place of brick. Both features, according to the architect-engineers who designed the project, have shown every indication of measuring up to conventional procedure at no extra cost to the owner over the estimated expense of standard practice.

Laid out on a large tract that allows expansion in three directions, the Sandusky project is reported to be the largest completely integrated ball-bearing manufacturing plant in the world. It supplements the existing facilities of the New Departure Division in New England and adds greatly to the capacity of this major producer of ball bearings. Electric power and water are purchased, but the plant is self-contained with respect to other utilities, even to its own sewage treatment plant, complete with settling basins and sludge-drying beds, designed to give full treatment to sanitary sewage.

All manufacturing departments are housed in a roughly U-shaped structure, with major dimensions of 1,040 x 900 ft., connected to the adjoining engineering and office buildings (Fig. 1). The forge and annealing departments are in one of two 90-ft. bays, serviced by 15-ton bridge cranes, in the major leg of the U, 700 x 182 ft. in plan. The main manufacturing area, housed in the remainder of the U-shaped structure, is made up of 60-ft. bays serviced by monorails and individual light cranes suspended from trusses under the roof.

Adjoining the engineering building, the main manufacturing building has a mezzanine containing the cafeteria and other employee facilities, on the same level with the second floor of the engineering building, where the locker rooms are located. The remainder of the manufacturing building is one-story. Overhead walkways supported in the roof trusses lead from the mezzanine to all parts of the manufacturing area, keeping foot traffic off the floor and avoiding accidents at shift changes. Stairways at convenient locations lead down to the production floor.

All buildings have structural steel frames, about 7,200 tons being re-

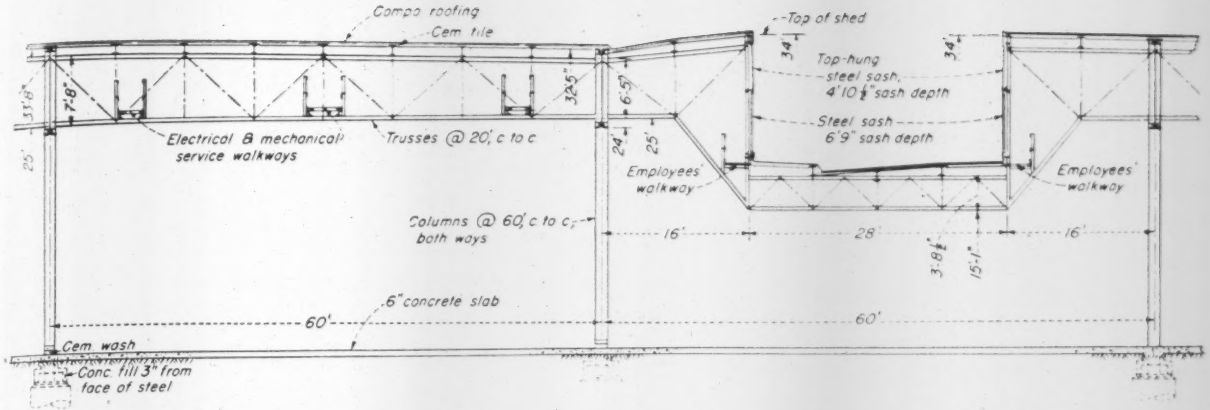


Fig. 2. Cantilever trusses supporting suspended trusses in alternate 60-ft. bays replace conventional monitor roof frame for daylighting interior of manufacturing area.

quired for the project. Walls are mostly steel sash and gunite. Cantilever trusses are used throughout the manufacturing area, with the ends of the trusses extending beyond the columns (on 60-ft. centers) to support shorter, suspended trusses at a lower level, thus furnishing vertical sash area for plant daylighting without the use of conventional roof monitors (Fig. 2). The elevated walkways for workers are carried through the cantilever ends of the trusses (Fig. 2).

Over the 90-ft. bay in the heat-treat wing, housing the forge and annealing departments, the roof is monitored to accommodate two continuous gravity-type ventilators each about 700 ft. long.

Caisson-drilled piers

Frozen ground would have been an obstacle to pier excavation during the winter if the plant constructors had not brought in from Texas a caisson drilling rig of a type first developed in San Antonio and later popularized in Fort Worth and other cities of the Southwest. The caisson boring and excavating machine for the Sandusky project was mounted by its Texas owner on a steam crane which furnished all the power necessary both for turning the drill stem and hoisting the loaded drill bucket (Fig. 3). The rig excavated 650 pier caissons 3 to 5½ ft. in diameter and 5 to 20 ft. deep to hard limestone bedrock. In some holes the rock had to be shot to level the bottoms.

Down the center of the heat-treat wing, footings under the columns supporting the two 90-ft. bays were designed with plan dimensions 3 x 11 ft. The footings were excavated by digging at each location four 3-ft. dia. shafts with the drill rig and squaring up the sides between the cylindrical holes with hand-held power tools, leaving the two ends rounded.

All piers except those carrying light loads are doweled into the seamy limestone. The dowels are 1¼-in. steel bars set 40 diameters into bedrock in 3-in. drilled holes and grouted.

With the exception of the office building, topped out for the present at the third floor level, but designed for addition of one more story when needed, all of the roofs are decked with precast lightweight concrete tile clipped to steel purlins. All joints between precast concrete deck slabs were sealed by calking with pitch mastic and covering with a 2-in. strip of saturated asbestos felt (Fig. 4).

Construction of the built-up roofing involved these steps: (1) pouring hot pitch on the concrete tile, or on insulation board; (2) laying three plies of glass fiber mat, shingle fashion, on the hot pitch; (3) pouring sufficient hot pitch with long-handled pouring pots to impregnate the three plies of glass fiber mat; and (4) spreading a top cover of crushed limestone. This is preceeded by the pouring of such additional hot pitch as is required.

Glass-fiber roofing mat

Original specifications called for conventional rag-felt roofing material. Its unavailability in sufficient quantity opened the way for fiber-glass suppliers, who agreed to take the contract at the original terms and to grant a 20-year guarantee in place of the conventional bond. The glass-fiber roofing gives a lighter roof load and has the added advantage, by virtue of the porosity of the mat, of waterproofing corners and crevices reached by pitch but not by layers of felt.

Insulation consisting of a 1½-in. glass-fiber board was placed on the roof deck over the cafeteria area of the plant and on the office building, and the built-up roofing was applied to the surface of the insulating boards. Elsewhere, the roofing was applied directly to the precast concrete deck. The roofing subcontractor was enthusiastic over the ease of application and the promise of serviceability of the glass-fiber-and-pitch construction.

Five physical properties of the glass-fiber mat first aroused the interest of the subcontractor in the new roofing material: (1) it is inert; (2) it is inorganic; (3) its capillarity is zero; (4) when saturated with pitch or asphalt, the tensile strength of the glass mat compares with that of conventional rag felts, and (5) the glass felt is so porous that smoke can be blown through it. After giving the material a thorough test on smaller jobs of good size, the roofing contractor was willing to recommend it to the general contractor and the architect-engineers for the New Departure plant. The architects agreed to specify the fibrous glass material in three-ply construction, supplanting the rag-felt materials originally specified in four-ply construction.

As demonstrated on the Sandusky job, it is feasible to lay three plies of glass-fiber roofing mat over either concrete deck or insulation board and then top-impregnate the three plies by pouring pitch onto the surface of the top ply. Complete impregnation took place down through the three plies of glass mat to the deck, and a satisfactory bond was obtained to the deck surface, resulting in a completely homogeneous built-up roof. In the words of the contractor, its homogeneity precluded any possibility of delamination or blistering. There was no possibility of entrapping air between the plies, as the porosity of the mat itself readily permitted all air and entrapped moisture to escape.

Method of impregnation

On the job, the roofing subcontractor's foreman watched the operation carefully to be sure that the entire surface was poured solidly to get full impregnation of all plies of the glass mat and that enough pitch was used on the top surface to give anchorage to the limestone chip surfacing. The roofing inspector's job was made easy by the fact that any shortening of the pitch requirement was readily apparent, a characteristic which assured confidence on the part of the architects that they were getting a good job.

After the roof deck had been primed with the first pouring of hot pitch (the initial step), the plies of mat were run out dry and poured, and the limestone chip crew followed right behind with the final operation. The top pouring on the glass mat usually was applied in such quantity as to impregnate the three plies completely but not to build up a volume of pitch on the surface until the limestone chip crew followed with the final pouring. This practice made it possible to carry on normal traffic over the glass roofing mat without damaging the mat and without any pickup on wheelbarrows or shoes. When impregnated in this way, the mat was tough and strong, even when roof temperatures ran as high as 130 and 140 deg. F.

On the butterfly monitor over the heat-treat building, with a roof slope of about 3½ in. to the foot, glass-fiber mat was applied directly to the precast concrete tile, without nailing, using steep pitch as the applying agent. Homogeneity of the built-up roofing on these slopes completely eliminated slippage between the several plies.

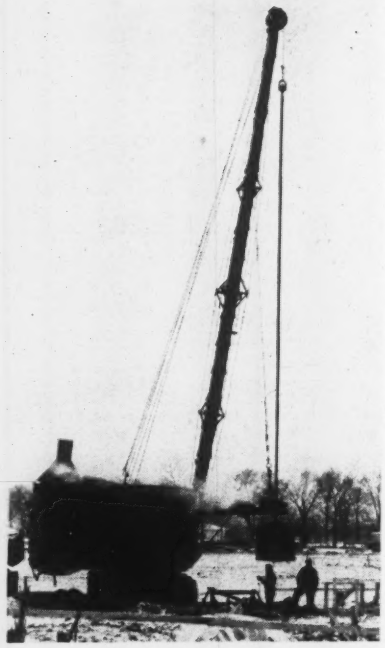


Fig. 3. Caisson drill rig mounted on a steam-powered crane excavates pier shafts 3 to 5½ ft. in diameter and 5 to 20 ft. deep through frozen ground to bedrock.

Each ply of the glass-fiber roofing mat weighed 1 lb. per square (108 sq. ft.) and retained 40 lb. of pitch per square. A roll of glass mat contained eight squares of the material and weighed, with paper wrapper, 8¼ lb. Because of this light weight, the material was easy to handle at all stages of distribution and application. Its light weight was not an unmixed advantage on windy days, when the material was somewhat hard to manage on the roof, but this difficulty was overcome with experience. The roofing crews made better progress than would have been attained with conventional roofing materials.

Walls and floors

The owners met the problem of a severe shortage of bricklayers in the area by using 8-in. gunite walls in the manufacturing and service buildings, thus being able to assign the available bricklayers to the office building, engineering building, boiler house and truck garage. Walls of the engineering and office buildings are faced with Norman brick (2 x 4 x 12 in.) laid in running bond.

Fill of about 2 ft. required under the concrete floor was made with limestone screenings or chat from nearby quarries. A brick surface was placed on sand fill and in some instances on concrete slabs in the forge department; elsewhere in some of the manufacturing areas a laminated wood finish floor was laid on top of the concrete slab and in other areas creosote wood block. The inspection room has edge-grain maple strip floor over the concrete slab.

Electrical and mechanical features

Primary electric power service is brought into the site at 34,500 v. to a master transformer station, where it is stepped down to 13,800 v. Thence it is distributed underground to six substations, five under the manufacturing area and one under the office building, which reduce the voltage to 460. At this potential, it is delivered through the plant by 8,000 ft. of inclosed bus bar (bus duct) distribution system installed high up in the trusses. The overhead bus bars have power takeoff openings every 12 in. on one side and every 24 in. on the other. Bus drop cables are used from the overhead inclosed bus-bar distribution system to the machines on the floor.

All of the six 13,800-460-v. substations are located underground, leaving the first floor clear for production requirements. Each substation has its own supply and exhaust fans bringing outdoor air in for ventilation, so that production dirt and dust, if any, will not be drawn past the transformers and switchgear.

Two primary feeders are available at each transformer. In case of trouble on the "normal" feeder, the transformer can be reconnected to the "alternate" feeder by moving a primary breaker to an adjacent cubicle. Two transformers are installed in each of the factory substations, each one feeding a set of 460-v. secondary switchgear. These two sets of secondary switchgear are connected by a bus-tie air circuit breaker which assures service with a minimum of interruptions due to electrical operations.

Voltage is stepped down at panel locations to 110-220 for lighting. Fluorescent lighting fixtures in the

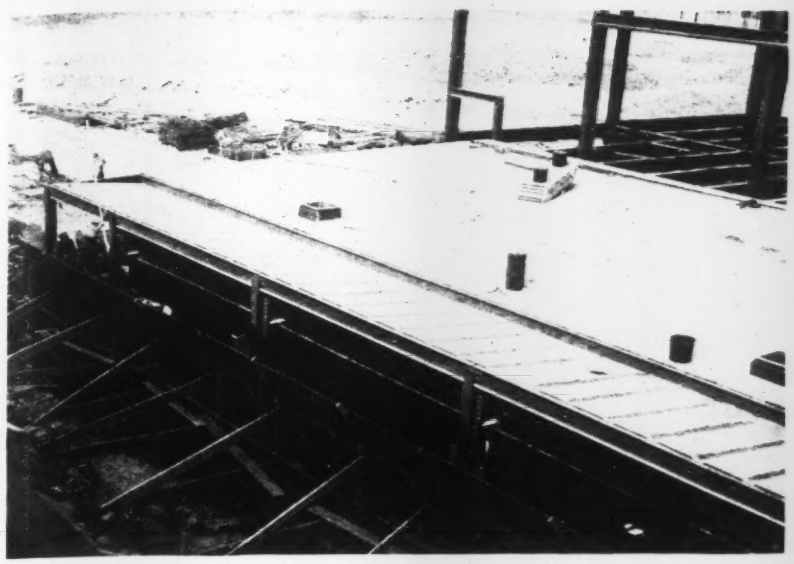


Fig. 4. A typical roof deck consists of precast, lightweight concrete tile with calked pitch mastic joints covered by a 2-in. strip of saturated asbestos felt.

Fig. 5. Pouring pots apply hot pitch to the top of three plies of glass-fiber membrane laid dry on top of hot pitch primer. Additional hot pitch is poured for anchorage ahead of limestone chip surface.

high bays of the manufacturing area (under the 60-ft. spans of the cantilever trusses) are so arranged that they can be swung up to catwalks in the trusses for maintenance service, thus eliminating use of trestles and ladders by the plant electricians. In the low clearance bays, under the suspended trusses, the lighting fixtures are designed to be serviced from the floor. The incandescent fixtures in the forge and annealing departments are serviced from the cranes.

The fixtures in the engineering and office buildings are flush-type fluorescent, 12 in. wide (the same width as the blocks in the acoustical ceiling), with glass doors. Throughout the office building, 110-v. power, intercommunication and telephone lines are distributed in an underfloor duct system, the ducts being installed in 2½-in. fill on top of the 4½-in. reinforced-concrete slab. Three underfloor ducts are run in each group, with the groups spaced 8 ft. on centers in the private office area and 5 ft. on centers in the general office area.

Closely controlled atmospheric conditions are required in the inspection department, instrument room and spindle room of the manufacturing area and in the standards and checking rooms of the engineering building. Year-round air conditioning is furnished in all these rooms, as well as in the cafeteria, and comfort cooling is supplied to the laboratory and the hospital area in the engineering building. The remainder of the engineering building and the office building are equipped with mechanical ventilation but not with air conditioning, although the office building has provision for future cooling.

Water is supplied to the plant from Sandusky through a cast-iron main. At the plant, water is stored in a 250,000-gal. elevated tank for fire protection and domestic service and in two ground storage tanks of 250,000 gal. each, one for fire protection and one for domestic supply. On top of the pump house is a cooling tower which cools water both for manufacturing processes and for the freon condensers of the air conditioning systems.

Designers and builders

Albert Kahn Associated Architects and Engineers, Inc., Detroit, designed the project and supervised construction for the New Departure Division of General Motors Corp. The National Concrete Fireproofing Co., Cleveland, was general contractor for all parts of the job except the steel, mechanical and electrical work. Structural steel was supplied by the Fort Pitt Bridge Works, Pittsburgh, and the mechanical and electrical contractors were, respectively, the John Winkel Co., Larchmont, N. Y., and the Miller-Brown Co., New York City. Built-up roofing was applied under subcontract by the Industrial Roofing and Sheet Metal Co., Cleveland, in accordance with Owens-Corning Fiberglas specifications.

Philip R. Chase, special representative, was in charge at the site for the New Departure Division of General Motors. For the architect-engineers, G. E. Hebert was superintendent on the job, while Paul L. Smith was project manager for the general contractor.

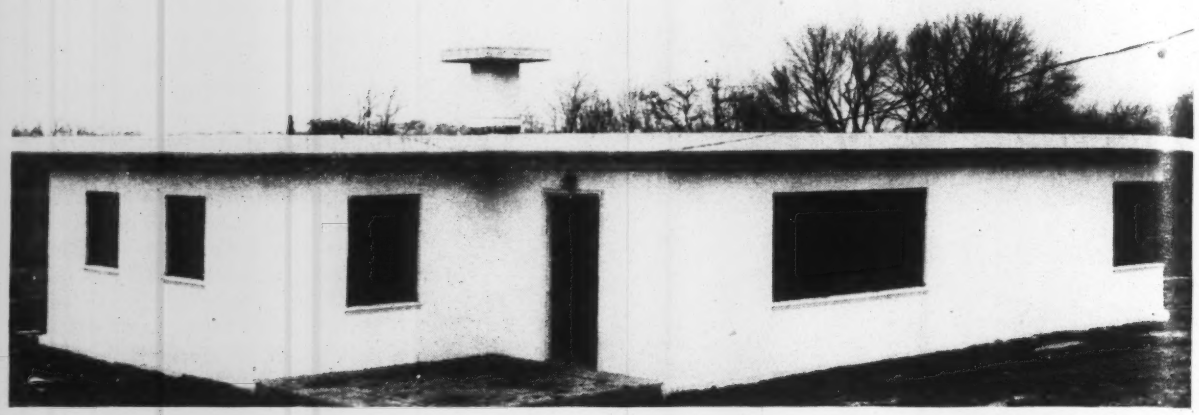


Fig. 1. Model house, type PCH 3, at Whitemarsh Village, Pa., is composed of precast concrete wall and roof panels.

Precasting Speeds House Erection

***Contents in Brief**—At full production, precast concrete houses are being erected at Whitemarsh Village, near Philadelphia, Pa., at the rate of six per day. For a 35x46-ft. one-story dwelling, 4 roof slabs and 11 wall units are required, and for a 32x49-ft. structure 5 roof slabs and 8 wall units are needed. Panels are removed from the forms about 18 to 20 hours after casting, combined to form a house and cured in place.*

To CREATE with utmost speed and economy the new Whitemarsh Village near Philadelphia, Pa., totaling about 600 one-story concrete houses, the builder is precasting and vacuum-processing wall and roof panels on a mass production basis. About six houses are turned out per day at full production.

Occupying only about 6 percent of the area of the 265-acre development, the buildings are oriented to conform to the terrain of the tract and to improve the appearance of the community. The smallest lot is 12,000 sq. ft. in area.

Heated by a hot-air, oil-fired system, type PCH 3 (Fig. 1) is 35 ft. 5½ in. x 46 ft. 5¼ in. and type PCH 3A is 32 ft. 1¼ in. by 48 ft. 7¼ in., both having three bedrooms. The former is composed of four roof slabs and eleven wall panels, and the latter of five roof slabs and eight wall units.

The ribbed roof panels vary in size from a minimum of 16 ft. 3¼ in. x 16 ft. 8¾ in. to a maximum of 18 ft. 10¾ in. x 25 ft. 7⅝ in. (Fig. 2). Supporting a 1¼-in. thick roof deck, ribs spaced 2 ft. 4½ in. apart in each direction are 6 in. deep overall, tapering in width from 3 in. at the bottom to 4½ in. at the deck. Reinforcing in the slab consists of 6 x 6-in. by No. 10 wire mesh; in the transverse ribs, of two ⅝-in. dia. bars; and in the longitudinal ribs, of one ½-in. dia. bar.

To insulate the roof, the deck is coated with asphalt mastic against which is placed aluminum foil for a vapor seal. Over this is loose lightweight aggregate to an average thickness of 4 in., a layer of building paper, 1-in. cement topping and 4-ply built-up roofing. In most cases, the under side of the slab will be left exposed and will be painted to serve as the ceiling.

Roof panels are supported on the exterior walls and on 14-in. beams spanning interior columns. The reinforcing used in these beams, which are precast integrally with the roof slab, varies with their length, but for a 16-ft. span, two 1-in. dia. bars are used at the top and three ¾-in. dia. at the bottom.

Sizes and spacing of the interior columns differ. The majority are 9 in. square on 10-in. square pedestals and 2-ft square footings. Depending on architectural requirements, spacing varies up to a maximum of about 16 ft. Wall-closure columns between precast wall slabs are 6 x 4 in., except at the corners, where they are 6 in. square.

Walls also precast in large panels

Wall units are 8 ft. high, with a maximum length of 27 ft. 5¼ in. Having a minimum thickness of 2 in., the slab spans about 4 ft. center to center of horizontal ribs and a maximum of 16 in. between centers of vertical ribs. The ribs have an over-all depth of 4½ in. and taper in width from 2 in. to 3 in. at the face of the wall.

Reinforcing in the wall slab consists of ⅜-in. dia. vertical bars spaced at 12 in., and ⅜-in. dia. horizontal bars spaced at 8 in. Steel in the horizontal ribs consists of one ½-in. dia. bar, and in the vertical ribs of one ⅜-in. bar. The horizontal reinforcing extends 8 in. beyond the ends of the wall slabs and is bent at erection to provide anchorage for the cast-in-place closure columns.

When the wall slabs are cast, continuous $\frac{3}{4}$ x 2-in. wood nailer strips are set in each rib and $\frac{1}{2}$ x 2-in. strips in interior roof beams over partitions. These strips provide a means for fastening the metal lath for application of plaster.

The wall panels are set in a key in the 8-in. thick foundation wall, which extends a minimum of 3 ft. below finish grade. No footings are used for the foundation wall.

Window openings are provided in the precast wall panels. The windows consist of a wood sub-frame and metal casement sash.

Resting on waterproofing on a 5-in. compacted cinder fill, the floors consist of a 1:7 cinder concrete mix, $2\frac{3}{4}$ in. thick, with a 1:4 topping.

Six houses per day scheduled

In planning the construction schedule, it was decided that if six houses per day were to be erected, all the components for that many houses would have to be cast in a 24-hr. period. Therefore, it was estimated that six sets of molds would be needed, apportioned four for type PCH 3 and two for PCH 3A.

Each set of molds for the latter consists of eight wall molds and five roof molds. For PCH 3, a set consists of eleven wall molds and four roof molds for the house, as well as three wall molds and one roof mold for the garage. Molds are made of reinforced concrete that had been cast on the site in negative wood molds.

The schedule calls for alternate cycles of casting and stripping varying in length from 18 to 20 hours. To obtain high, early strength, a mix containing six bags of standard portland cement and $1\frac{1}{2}$ percent calcium chloride is used and vacuum processed.

The vacuum treatment consists of an application of a suction mat to the freshly cast concrete to draw off excess water. For this purpose, a vacuum of 25 in. of mercury is used, supplied by a rotary pump capable of handling 1,000 cu. ft. of air per min. at 20 in. of mercury.

Prior to pouring, molds are cleaned and oiled, and reinforcing cages are set in place. Concrete comes to the job in truck-mounted mixers, and immediately after the concrete is placed, the vacuum mat is applied.

On the following day, the panels are removed from the molds. For this

Fig. 2. In the interior of the precast concrete houses, the under side of the roof slabs will be left exposed and painted to serve as a ceiling.

Fig. 3. Wall slabs are raised by means of a special gripping device and set in grout in a key in the foundation wall top.

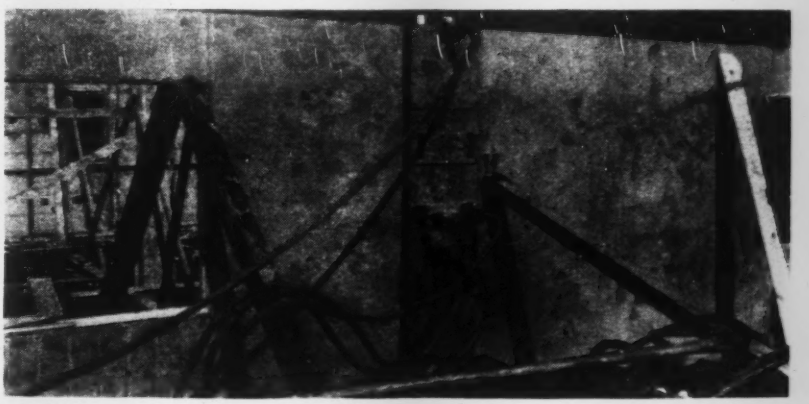


Fig. 4. Forms held in place by vacuum are used in making cast-in-place concrete closures between adjacent wall units.

Fig. 5. Roof slabs up to 19 ft. wide by 26 ft. long are set in place by a crawler crane. They rest on the exterior walls and a beam spanning interior columns.

purpose, vacuum is again resorted to. A crawler crane sets a vacuum mat on the upper surface of a panel and a suction of 20 to 25 in. of mercury is applied. The seal between the under side of the panel and the mold is broken by a burst of air pressure released from pipes embedded in the mold, and the crane then is able to lift and place the slab directly on a trailer truck for delivery to a nearby dwelling site.

A crawler crane is also used to remove the panels from the trailer. The walls are lifted by means of a special gripping device that is fastened around the top rib of the units (Fig. 3 left). Thus, when the panel is free of the trailer, it is suspended by its top in a vertical position. The base is set in grout in the key in the top of the foundation wall, and the panel plumbed and shored up temporarily (Fig. 3 right). Closure between adjacent wall units is accomplished by means of concrete which is cast in forms that are held in place by suction (Fig. 4).

Roof slabs are removed from the delivery truck by a crawler crane utilizing U-bolts that had been embedded in the slab for that purpose and that are later removed (Fig. 5). After the roof is placed, a precast concrete chimney is slid through a square opening in it. The concrete superstructure is then permitted to cure in place.

Finishing operations include placing of the floor, roof insulation and roofing partitions, interior wall finish and windows.

Whitemarsh Village is being built by McCloskey Homes, Inc., M. H. McCloskey, Jr., president, for whom Nelson Tallman is general superintendent. R. E. McLaughlin is chief structural engineer, and M. H. McCloskey, III, is project manager. Field execution of precasting methods are under the supervision of Vacuum Concrete, Inc. J. Ethan Fieldstein is the architect.

Precast Bungalows Shelter Navy Families on Guam

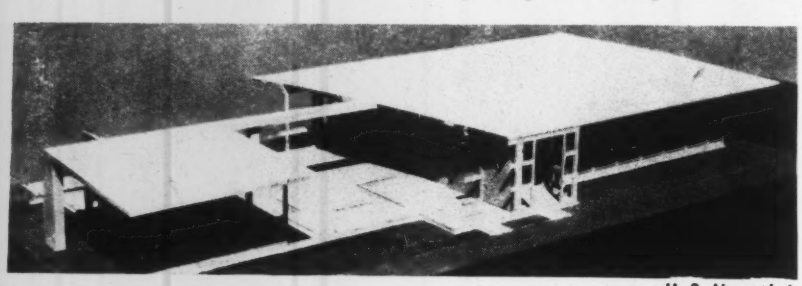
Duplex bungalows using reinforced concrete panels precast at the site are being constructed to house dependents of enlisted Navy personnel stationed at Guam. The design was developed by the Navy Bureau of Yards and Docks to simplify overseas shipment and labor problems.

Consisting of a living room, dining room, two bedrooms and front and service porches, the units are 28 ft. 2 in. wide by 35 ft. 10 in. long by 9 ft. 6 in. clear height. Floors are concrete, 4 in. thick, set on coral gravel fill. Interior partitions are made of ¾-in. plywood, but the exterior is formed mainly by screened jalousies, which extend from floor to ceiling to provide ventilation on the three exposed sides of each unit.

The jalousies are set in full-story height, precast concrete panels varying in length from 3 to 18 ft. and composed of vertical and horizontal ribs 6 in. wide by 5 in. thick. These wall panels also help support the flat, insulated roof, which has a wide overhang for protection against sun and rain. Made up of concrete slabs about 8 ft. wide, 19 ft. long and 1½ in. thick, with 5½- to 10-in. deep ribs spaced at about 4 ft., the roof also rests on a centrally located ridge beam, which in turn is supported at midspan on a concrete party wall and at the ends on exterior columns.

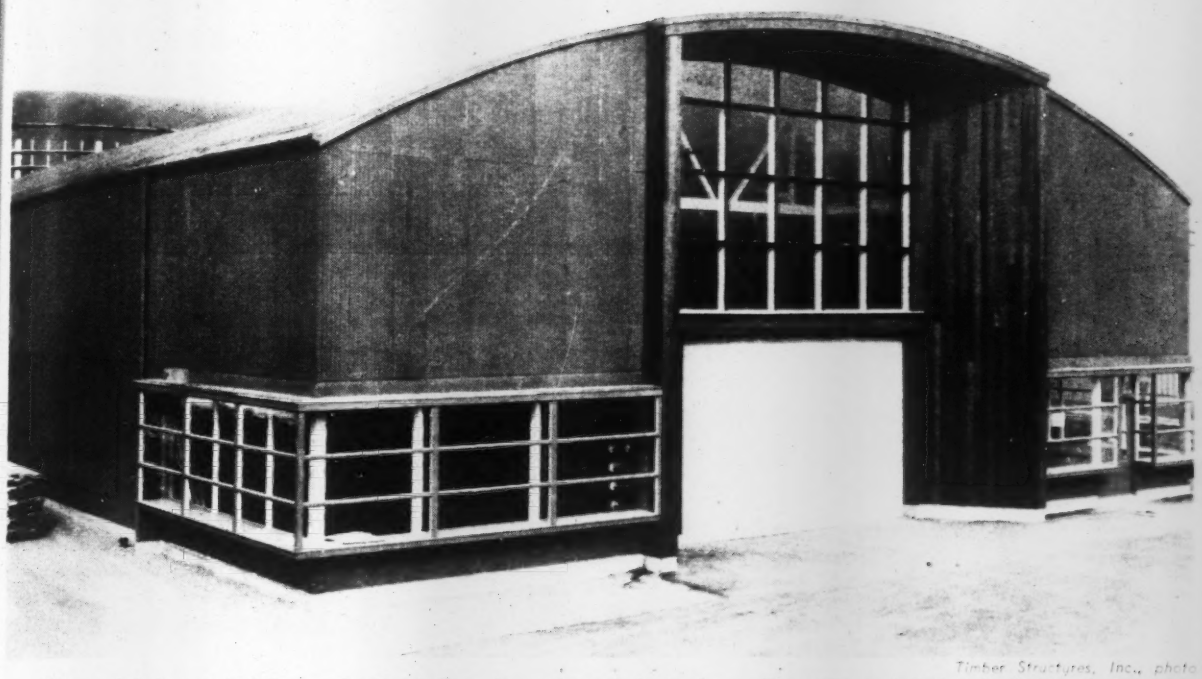
The bungalows were designed for a live load of 15 psf., winds of 125 mph. and earthquake factor of 0.10g. The allowable soil pressure was assumed at 2,000 psi. The allowable stress in concrete footings and slabs on ground was taken as 2,000 psi., in the concrete superstructure as 3,000 psi., in reinforcing steel bars as 20,000 psi., and in the reinforcing wire mesh as 30,000 psi.

Blanchard & Maher of San Francisco are the architects. The contractor on Guam is the Pacific Island Engineers. Capt. E. L. Hansen, CEC, USN, is in charge of construction for this contract, and Rear Admiral Edward Marshall is public works officer for the Marianas area.



U. S. Navy photo

Model of precast concrete bungalow now being built on Guam, with a portion of the roof removed to show construction.



Timber Structures, Inc., photo

This prefabricated building at Portland, Ore., has corrugated aluminum side walls and timber bowstring trusses.

Industrial Plants Packaged to Order

Frederick S. Merritt
Assistant Editor, Engineering News-Record

***Contents in Brief**—Manufacturers of standardized, prefabricated industrial buildings report that the demand for this type of structure is increasing, and they are stepping up production accordingly. Packaged plants are available in metal or wood in almost any lengths, clear widths up to 150 ft., and clear heights usually up to about 25 ft. Their purchase is attractive because of low cost and quick delivery.*

Economy and availability of standardized, prefabricated industrial buildings are proving so attractive to purchasers that production is being stepped up, according to an *Engineering News-Record* survey. Eliminating piece-meal buying of components, these packaged plants are obtainable in various metals and timber and in convenient dimensions.

To keep pace with this important trend, one well-known fabricator recently converted part of his output to packaged buildings, although his facilities were operating at full capacity, and demand was high for components of custom-built plants. Evidently this was a wise act, for he is now in the process of increasing production of the prefabricated units.

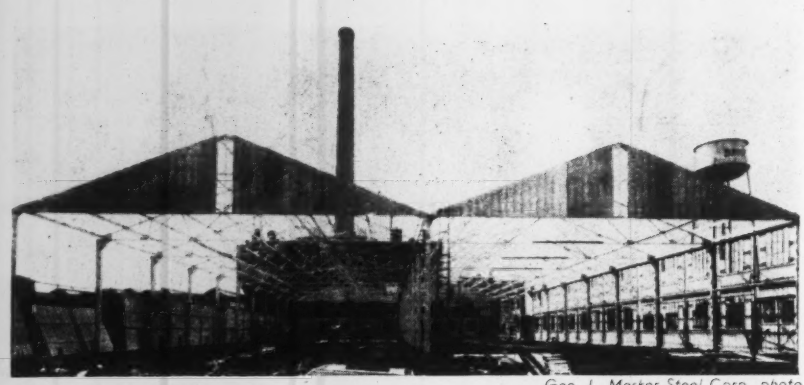
From the catalogs of this manufacturer, a prospective owner may select a shop-fabricated, multipurpose building to suit his needs for a cost as low as $1 per sq. ft. f.o.b. factory. Furthermore, he may expect to have the complete structure shipped to him within 14 to 30 days after receipt of his order.

The experience of this fabricator is somewhat typical, according to replies received to a questionnaire sent to the packaged-plant industry. Most of the manufacturers report that their plants are now operating at better than 60 percent of capacity, and that they are increasing production to meet an ever rising demand. Prices range from about $1 to $2.50 per sq. ft., with delivery varying from two weeks to six months from receipt of order, depending on the size of the structure.

Advantages of packaged plants

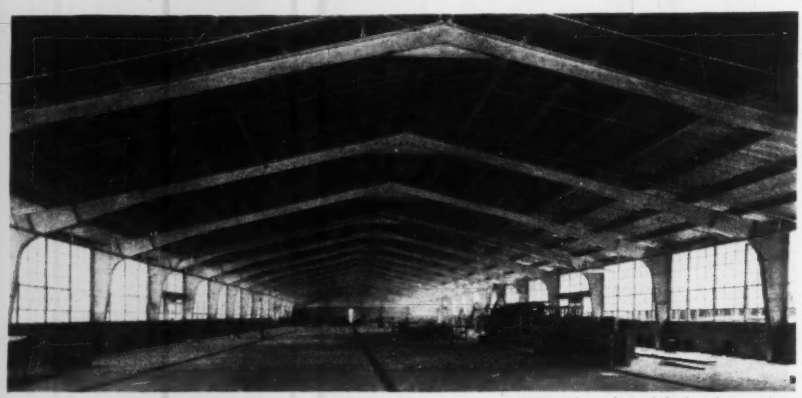
A consensus of the industry indicates that economies obtained through purchase of a packaged building are multifold. Mass production of standardized designs keeps initial cost low. Careful factory assembly, compact shipping and reduction of on-site labor hold erection costs down, and in many cases unskilled labor can raise the building quickly and easily. Salvageability is high, because of versatility in enlargement, dismantling and re-erection.

In achieving these economies, there



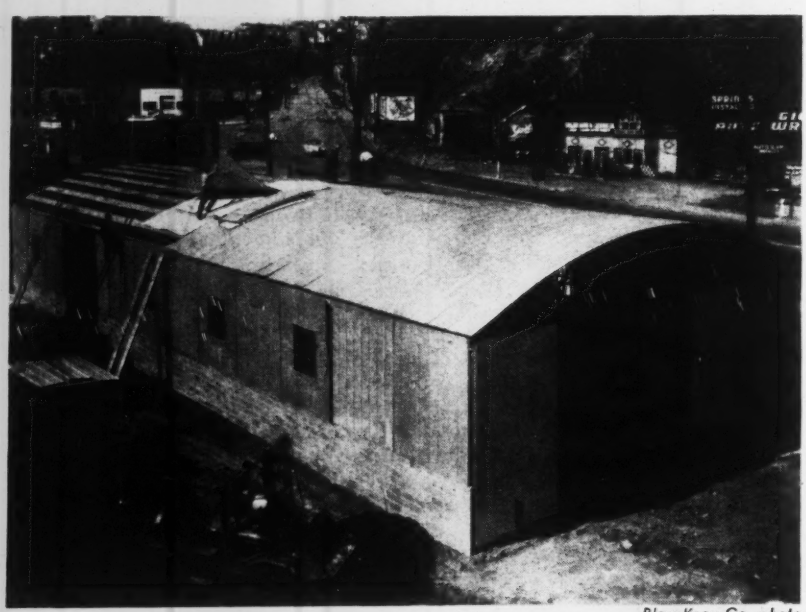
Geo. L. Mesker Steel Corp. photo

A sectional building for the Briggs Body Plant at Evansville, Ind., is 100x200 ft., with 18-ft. high walls of galvanized steel.



Independent Iron Works, Inc., photo

Steel rigid frames span the 75-ft. width of the 420-ft. long structure built for the Friden Calculator Co. at San Leandro, Calif. Walls are concrete block, with precast concrete sills and continuous steel sash above, and a built-up composition roof is laid on wood sheathing supported on steel purlins.



Blaw-Knox Co. photo

Galvanized roof sheets for a 40x104-ft. packaged plant are laid on pan-type purlins carried on welded steel trusses spaced 8 ft. apart. Wall panels consisting of galvanized steel sheets on a welded steel frame are 10-ft. high and insulated. Gable-end sliding doors are 14 ft. high.

does not appear to be any sacrifice of quality. Manufacturers claim low maintenance, fire and lightning resistance, and attractive appearance.

One indication of the acceptance of these buildings is their ability to satisfy city building codes. Many manufacturers report that they have no difficulties with urban codes, some that they have no more trouble than with custom-built plants, and only a few that they sometimes meet up with restrictive laws. To insure efficient application of packaged buildings to industrial use, some of these companies maintain competent engineering organizations throughout the country to cooperate with owners, contractors and architects.

Two types of frame available

In almost all cases, manufacturers supply only the building frame and enclosure. The owner must supply his own floors and sometimes even the roofing. Also mechanical and electrical equipment, such as lighting, power wiring, heating, sanitary facilities and piping are, in general, not obtainable from the manufacturer. In about an equal number of cases, the seller will erect or recommend a contractor, or the owner must hire a contractor.

Structurally, packaged buildings are of two types—one using load-bearing wall panels and one using skeleton construction. The length of structure can be varied in smaller increments for the first type than for the second, since the former can be made longer by adding additional wall panels and the latter generally requires addition of complete bays. Thus, it is possible to obtain buildings with a length in some multiple of 2, 4, or 8 ft. from some manufacturers, while in other cases lengths can be had only in increments of 8 to 20 ft.

On the other hand, where a skeleton frame is used, it is generally possible to order buildings with greater clear widths and heights. Structures are obtainable in clear widths from as low as 6 ft. for a load-bearing type up to 150 ft. with truss or rigid-frame construction. Larger total widths can be achieved by combining units. Heights, however, are available in a much narrower range—generally 8 to 25 ft. clear.

The buildings are commonly of

metal, with structural steel being used most extensively for columns and roof members and galvanized copper steel sheets for walls and roofs. In some cases, light-gage steel or timber is used in the structural frame, and pitch-protected steel, aluminum, asbestos-cement or plywood in the walls and roofs. Metal walls are usually corrugated for greater strength, and insulation against heat is optional in most cases.

Whether the walls are solid or incorporate openings, panels are interchangeable. Thus, doors and windows can be located anywhere along the perimeter of a building. Choice of louvers in gable panels or ridge ventilators is left to the purchaser.

For the future, it appears that packaged buildings will continue to be in demand because of their low price and availability. Most likely, more manufacturers will include built-in mechanical and electrical equipment. Heating and air-conditioning units and prefabricated electrical substations, for example, could readily be incorporated now in offering of completely packaged plants.

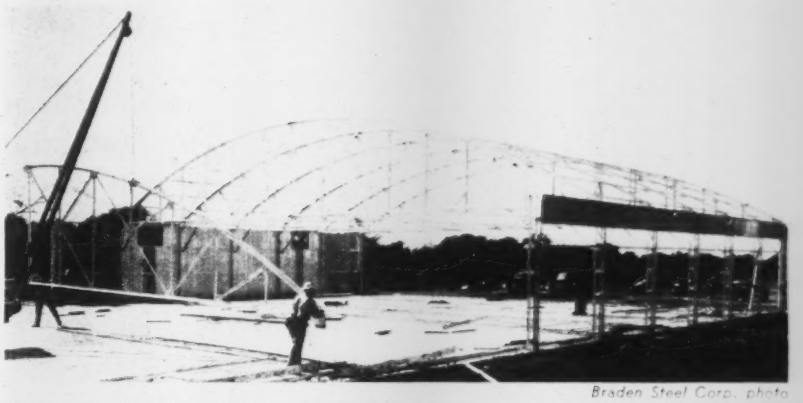
A packaged substation now available is designed and manufactured as a unit, coordinating all components to a high degree. Shipped assembled as completely as possible for rapid installation, it includes all required equipment—steel structure, lightning arresters, copper bus, frame-mounted oil circuit breakers, transformers and metal-clad circuit breakers. Savings are estimated at 20 percent over field-assembled equipment.

Acknowledgment

Manufacturers of packaged industrial buildings who contributed information used in this article are: Armco Drainage & Metal Products, Middletown, Ohio; Timber Structures, Inc., Portland, Ore.; Braden Steel Corp., Tulsa, Okla.; Independent Iron Works, Oakland, Calif.; International Derrick & Equipment Co., Columbus 8, Ohio; Belmont Metal Co., Bronx, N. Y.; Truscon Steel Co., Youngstown, Ohio; Steelcraft Manufacturing Co., Rossmoyne (Cincinnati), Ohio; Maryland Metal Building Co., Baltimore, Md.; Butler Manufacturing Co., Kansas City, Mo.; Geo. L. Mesker & Co., Evansville, Ind.; and Blaw-Knox Co., Pittsburgh 30, Pa.

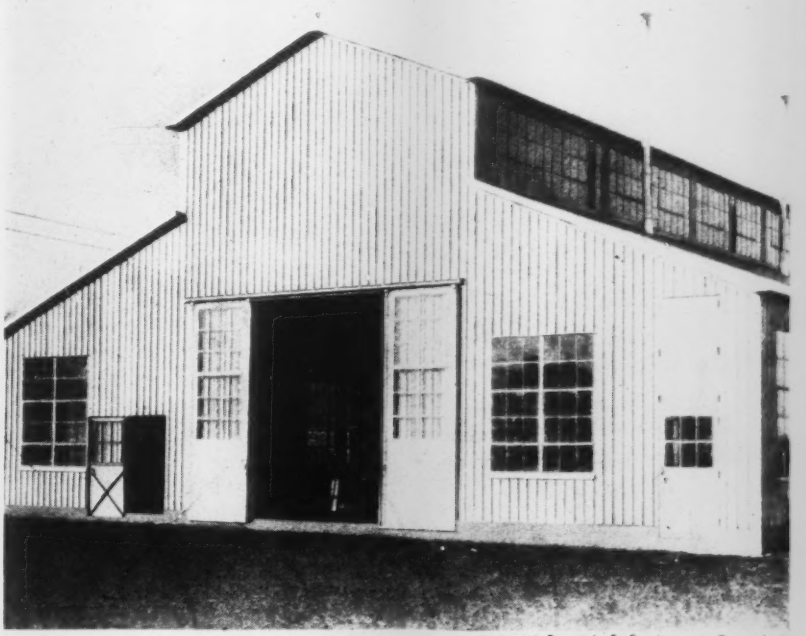
Steelcraft Mfg. Co. photo

Formed by aluminum panels on a structural steel frame, this building comes in 32-ft. widths, lengths in multiples of 14 ft. and sidewall height of 12 ft.



Braden Steel Corp. photo

Above, the steel frame for an 83 x 100-ft. hangar is being erected. Walls consist of 12-ft. high prefabricated panels of 24-ga. corrugated galvanized iron. Built for a flying school, it is equipped with 12-ft. sliding doors that can be opened to an 80-ft. width.



International Derrick & Equipment Co. photo

This gable-with-monitor mill building has a structural steel frame with trusses spaced 20 ft. on centers. The deep-ribbed 24-ga. galvanized steel side walls are used in heights up to 12 ft. without intermediate girts.

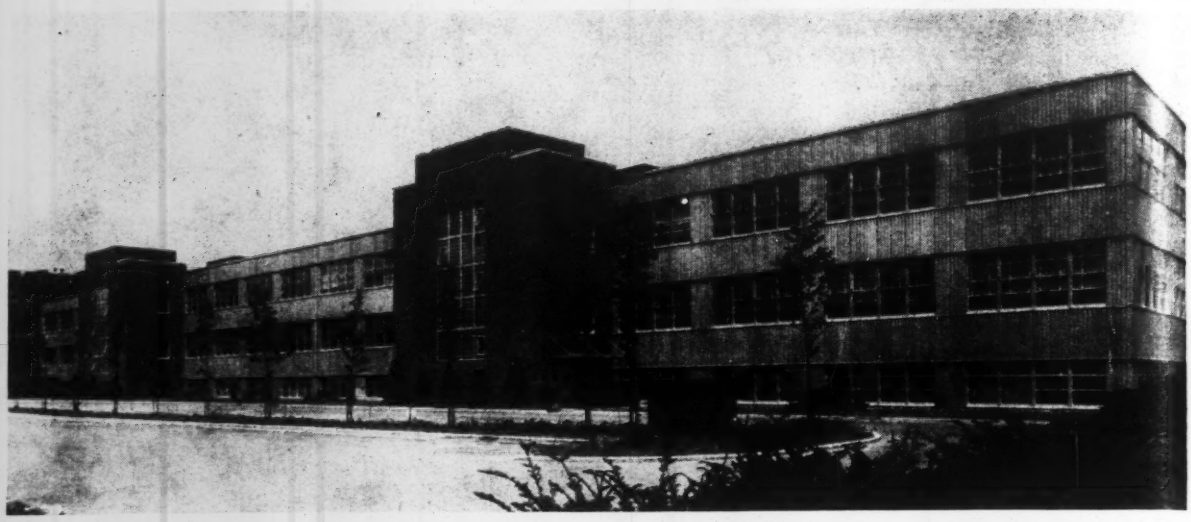


Fig. 1. Steel-and-aluminum panels form most of the exterior of the Country Life Press building at Garden City, L. I.

Experiences With Panel Construction

L. F. Booth
George A. Fuller Company
New York City

Contents in Brief—*In erecting the Country Life Press building at Garden City, L. I., the Federal Telecommunications laboratory at Nutley, N. J., and the Doubleday publishing plant at Hanover, Pa., the builder found that use of large metal panels for floors and walls had many advantages. In these structures, floors are composed of cellular steel plank and exterior walls of insulated, steel-and-aluminum panels. Interior partitions of asbestos-cement slabs clipped to steel studs are used in the laboratory.*

MASS-PRODUCTION techniques used so effectively in many industries to lower costs are finding greater application in the building field now than ever before. One instance of this trend is the development of large-size, shop-fabricated panels delivered to the site ready for installation as walls or floors. This type of construction was adopted for three buildings recently erected by the George A. Fuller Company and proved to have many advantages from the builder's viewpoint.

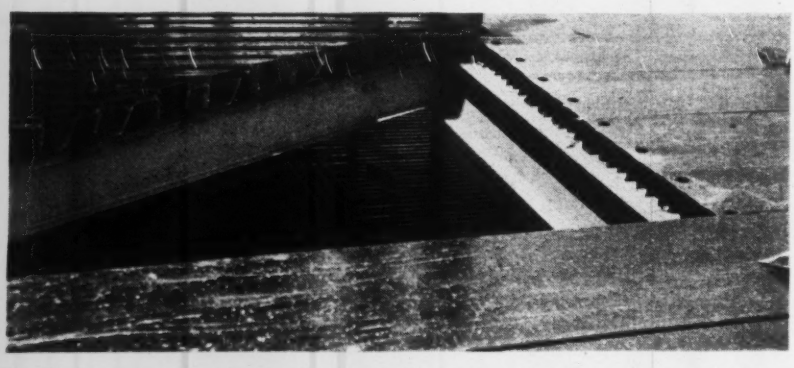


Fig. 2. At an opening in the floor, details of the steel floor plank are visible. Cells at the left were shop-fabricated of two fluted sheets, and at the right, where loads are lighter, the upper corrugation was omitted.

These structures are the Country Life Press building at Garden City, L. I. (Fig. 1); the Federal Telecommunications laboratory at Nutley, N. J. (Fig. 3); and the Doubleday publishing plant at Hanover, Pa. Two and three stories high, they have conventional foundations and steel frames but utilize panel construction for most of the floors and walls.

In the 100x420-ft. Country Life Press building, in which the floor system is designed for a 200-psf. live load, columns are spaced about 20 ft. apart in typical bays, and beams about 6 ft. 8 in. apart.

One section of the Federal Telecommunications laboratory is about 58x400 ft. in plan and the second, now under construction, 58x375 ft. Columns are spaced 27 ft. apart in typical bays, and beams 13 ft. 6 in. apart, with the floor system designed for a 150-psf. live load.

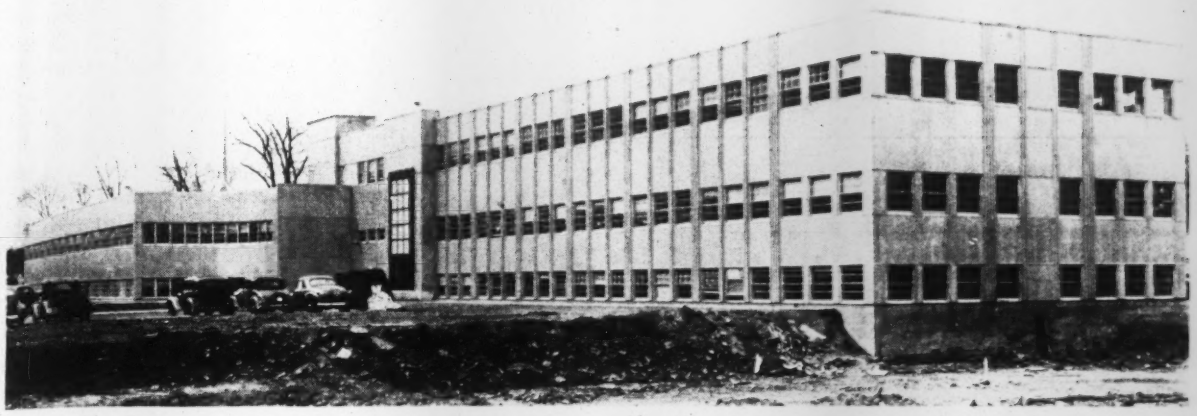


Fig. 3. Exterior walls of the first section of the Federal Telecommunications laboratory at Nutley, N. J., are composed of prefabricated steel-and-aluminum panels with a flat outer surface, as contrasted with the fluted exterior shown in Fig. 1.

The Doubleday plant, designed for 50-psf. live load on mezzanine floors and roof is 390x520 ft. in plan, with columns spaced at 20 ft. and beams at 6 ft. 8 in. in typical bays.

Floorplank prefabricated

In these structures, floors are composed of 2-ft. wide cellular steel planks that are delivered to the job cut to size and ready to erect. They are fabricated of two fluted steel sheets welded together to form small cells spaced about 6 in. on centers (Fig. 2). Available in lengths up to 22 ft., with flutes of various depths and metal of various thicknesses, they are light enough to be placed in position by hand, sufficiently strong to carry required floor loads, and sufficiently stiff to keep the deflection within desirable limits.

The panels are secured to the structural frame by welding. Set end to end, cells are continuous and serve as conduits for electric and other services. If occasional header ducts are placed transversely over the cells, utility outlets may be provided within a short distance of any point in the area.

After the steel floor planks are placed and welded, a lean concrete fill to a depth of 1½ in. over the high corrugation and a cement-sand finish 1 in. thick serve as the finished floor or a surface for the application of asphalt tile or such other finish as is desired. All hangers, such as are required for hung ceilings, lighting fixtures and piping, are easily provided, either by welding a stud to the bottom of the steel floor or by drilling holes and installing hangers before the cement fill and finish are placed.

The design of the exterior walls of these buildings represents an even more notable departure from orthodox practice. Welded to steel angle girts that are part of the building frame, prefabricated 2-ft. wide steel-and-aluminum panels span from window head to sill above, or a complete story height, as the location requires. Insulation is provided by 1½-in. thick bats of glass fiber, set in the panels at the factory (Fig. 4). Extruded aluminum shapes, bolted to the steel girts, are used to close the ends of the panels and act as window heads and sills.

The basic wall panel allows for considerable variation in make-up to meet

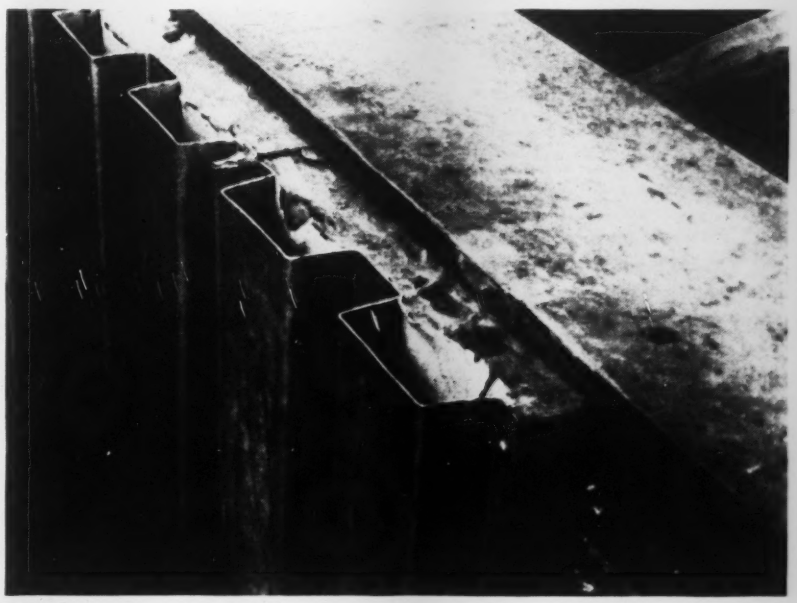


Fig. 4. Close-up of the factory-assembled wall panel used for the Country Life Press building: Corrugated 16-ga. aluminum sheet forms the exterior, flat 18-ga. steel the interior; 1½-in. thick glass fiber serves as insulation, and saturated asbestos felt as the separator.

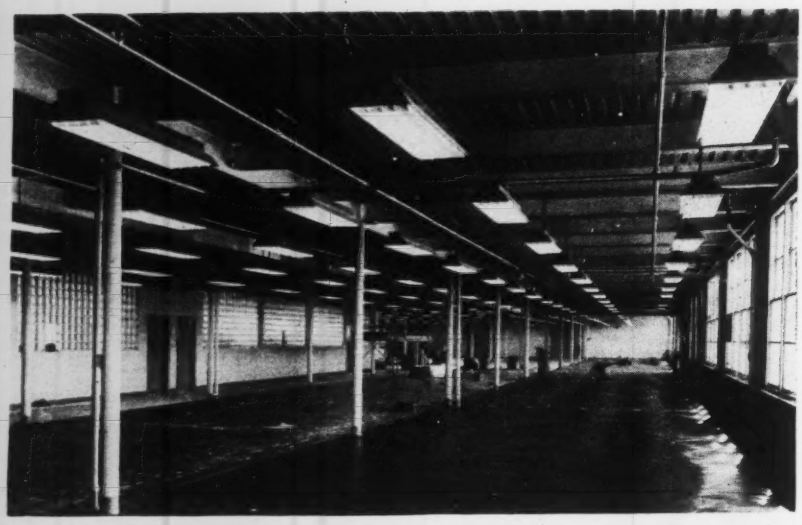


Fig. 5. Floor finish of asphalt tile is being installed in the Country Life Press building. Air conditioning ducts are visible at the left.

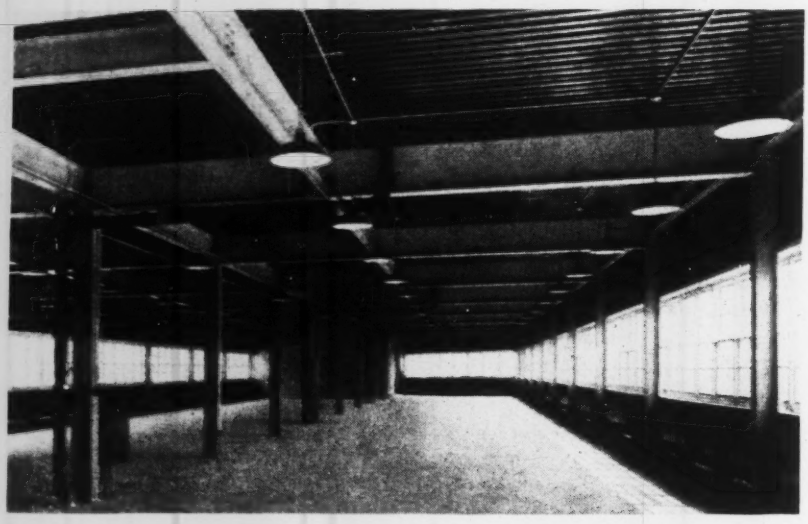


Fig. 6. General orderliness and lack of debris are apparent as a result of using panel construction in the Nutley laboratories. Here, as in Fig. 5, the under side of the steel plank is coated with aluminum paint to form the ceiling.

the different requirements of architectural design. In the Federal Telecommunications laboratory (Fig. 3), the inside supporting steel surface is corrugated and the exterior aluminum smooth. In the Country Life Press building (Fig. 1), on the other hand, the supporting steel is smooth and the aluminum surface is fluted to produce lines desired for architectural effect. And in the Doubleday plant, fluted-exterior wall panels are combined with a natural-stone foundation wall to produce an extremely pleasing exterior.

Heat loss with this type of wall has proved surprisingly small. For the first unit of the laboratory, heating engineers based their computations on a heat transfer of 0.14 Btu. per sq. ft. per deg. per hr., and two boilers were installed accordingly. Through the first winter of operation, which was a rather severe one, the second boiler was never required to be used, and it is available to pick up part of the anticipated load of the section now under construction.

A calking compound is applied to all joints in the walls, and the result is an unusually watertight exterior. During the first year of operation, the first unit of the laboratory was exposed to numerous severe, driving rainstorms and no leaks appeared. Another maintenance advantage has been that the aluminum surface is virtually self-cleaning with each rain and, with no attention, retains its pleasant sheen.

Removable partitions used

A special requirement of the laboratory is a large degree of flexibility in the interior layout, due to the fact that the different research projects require varying amounts of space and utility services. This flexibility is achieved by using interior partitions of 4-ft. wide, story-height asbestos-cement panels clipped to special steel studs. The partitions erected on top of the asphalt-tile floor are firm and sound proof and yet can be shifted overnight by the maintenance forces of the plant.

In the laboratory layout the basic module size is 6 ft., which is the distance between mullions in the continuous exterior windows. All utility outlets, lighting fixtures, sprinkler heads and acoustic ceiling pans are arranged to accord with this module size so that partition shifts of 6-ft. multiples can be made without disturbing them.

Some pros and cons

In general, from the builder's point of view, the advantages and economics of panel construction of buildings arise from the reduction of on-site labor, speed of construction, general cleanliness and orderliness (Fig. 6), and lack of weather interruptions. Furthermore, since formwork is eliminated and temporary heating is not required, the fire hazard is materially reduced.

In particular, advantages of a prefabricated panel floor from a construction point of view are many. The floors can be installed as fast as the framework goes up, and a working platform is available for all trades from the moment the planks are placed. In fact, this is accomplished in less time than is ordinarily required to build floor forms alone, much less the additional time required to place reinforcing and concrete. In addition, materials and equipment awaiting use can be stored on the floor where they are to be used.

Advantages of the prefabricated

panel wall from a builder's point of view are also numerous. Masonry debris, mortar spillings and clean-up work normal to ordinary wall construction are completely eliminated. Also, the proportion that on-site labor cost bears to total labor and material cost is much smaller than with conventional masonry construction.

From an architectural viewpoint, the panel walls lend themselves to a variety of treatments and combinations. Much of the finished exterior can be produced and assembled under factory conditions, which makes possible workmanship and uniformity that is costly to obtain under field assembly methods.

On the other hand, as with anything new, certain difficulties have to be overcome. In the case of the jobs referred to here, jurisdictional disputes slowed the speed of construction. The new methods and materials involved overlapping trades, and no precedents were available for the settlement of conflicting claims for the work. There seems some likelihood, however, that this problem will be less troublesome in the future.

Costs on these jobs, despite the fact that they are experimental or pilot projects, compare more than favorably on either a cubic-foot or square-foot basis with the costs of conventional-type buildings of comparable quality.

How widely or quickly these construction innovations will find more general use is, of course, problematical. Antiquated building codes in many localities would rule them out at this time. However, it appears probable that changes in these codes will be forced soon.

The Country Life Press building and the Doubleday publishing plant both were designed by H. T. Lindeberg, the first section of the Federal Telecommunications laboratory by Louis S. Weeks and the second section by Giffels & Vallet, Inc.—L. Rosetti, Architects and Engineers. The metal wall and floor panels were fabricated by H. H. Robertson Co. George A. Fuller Co. is the general contractor.

Rigid Frames Reduce Cost At Boys Town

John D. Griffiths
District Engineer, American Institute of Steel Construction
Omaha, Nebraska

***Contents in Brief**—The proportions of the main dining hall at Father Flanagan's Boys Home, Boys Town, Neb., lent themselves to the economical use of steel rigid frames. This type of construction is generally cheaper than trusses for spans from 40 to 80 ft., and for cases where exterior wall height is reduced while maintaining specified clearance under the framing, its use leads to overall savings.*

THE ECONOMY of a rigid-frame layout in structural steel, as compared with other possible framing arrangements, was strikingly brought out in the construction of the new dining hall at Father Flanagan's Boys Home at Boys Town, Neb. While the shape of this building was especially favorable for a rigid-frame design, conclusions that can be drawn from experience on this project are also valid for many other types of structures.

A great deal of time and study has been given to cost comparisons of rigid-frame vs. truss-and-column and other types of framing for one story, single-span buildings of various proportions. Each type has its place, and in many cases, any cost differen-

Fig. 1. The new, one-story main dining hall at Father Flanagan's Boys' Home, Boys Town, Neb., is 40x126 ft., with a center ridge almost 40 ft. high. Eaves are about 10 ft. above the floor.

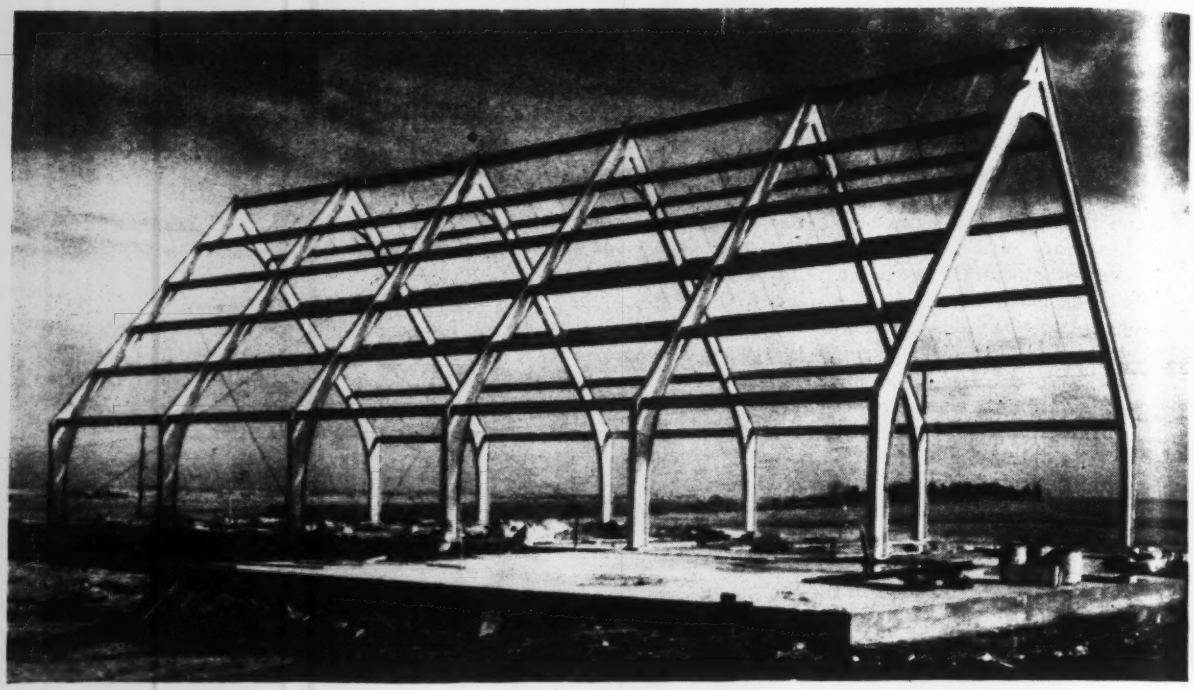


Fig. 2. Steel rigid frames spanning 40 ft. and spaced 18 ft. apart support the wood-plank roof deck of the dining hall.

tial may be so slight that other advantages, peculiar to each system, will govern.

The clean, compact lines and unobstructed headroom afforded by a rigid frame may become the ruling factor. On the other hand, the availability of the lower chord of a truss to support, for example, a ceiling having an entirely different outline from that of the roof, may be the deciding consideration. When the selection hinges solely on the relative costs of the two methods of framing, the span length, the total-height-to-span ratio, the roof-height-to-column-height ratio, and the total load per square foot of roof are all factors affecting the comparison.

When rigid frames are economical

Proportions such that a rigid frame can be fabricated from rolled shapes usually offer the most effective field for this type as far as cost comparisons are concerned. In general, it may be said that the most economical results are achieved in a span range from about 40 to 80 ft. Comparisons most favorable to such frames usually result when the required roof slope is relatively steep and the distance to the eaves relatively small, although rigid frames having around 100-ft. spans and nearly flat roofs have been found to be competitive with truss-and-column designs. Also, where the height of the structure has been dictated by clearance under the framing, reduction in exterior wall height has resulted in an over-all saving.

The number and location of field splices, as governed by maximum permissible shipping dimensions, have an important bearing on both fabrication and erection costs—particularly on the latter. A steep-gabled roof frame can often be shipped in two pieces, requiring but one field splice.

Frames erected in one piece

In the case of the new 40x126-ft. main dining hall at Boys Town, the roof rises steeply to a center ridge 38 ft. 9 in. above the floor of the hall, while the eaves are but 10 ft. 2½ in. above this floor. To support the roof, which consists of 2-in. wood plank resting on steel purlins, transverse frames, 18 ft. c. to c., of 18-in. WF 47-lb. structural steel shapes, were shop fabricated in two pieces by welding, assembled at the site before erection and raised in place as single units. Shop fabrication consisted chiefly of widening out the sections at the haunches and at the ridge and was much simpler than would have been required for trusses. All field connections, including those for the 10-in. purlins that frame to the webs of the rigid frames, were bolted.

The steepness of the roof and the modest proportions of this structure were particularly well adapted to effect better-than-average savings through the use of rigid frame construction. Furthermore, contractor's figures showed more than a 50 percent saving in the cost of the structural frame, as compared with that of an originally contemplated rigid-frame design using another material. Field erection was actually a matter of hours rather than weeks, as would have been the case with the former design.

Soon to be erected also at Boys Town are the 150-ft. span rigid frames of structural steel supporting the roof of the new field house, providing a vertical clearance of 56 ft. 6 in. for indoor sports. These frames will also support a 17-ft. wide balcony on each side, cantilevered inward from the columns to leave an unobstructed playing floor below.

Leo A. Daly Co. of Omaha are the architects for all work at Boys Town. Peter Kiewit Sons Co. are the general contractors. Structural steel was furnished by the Omaha Steel Works and the Gate City Iron Works.

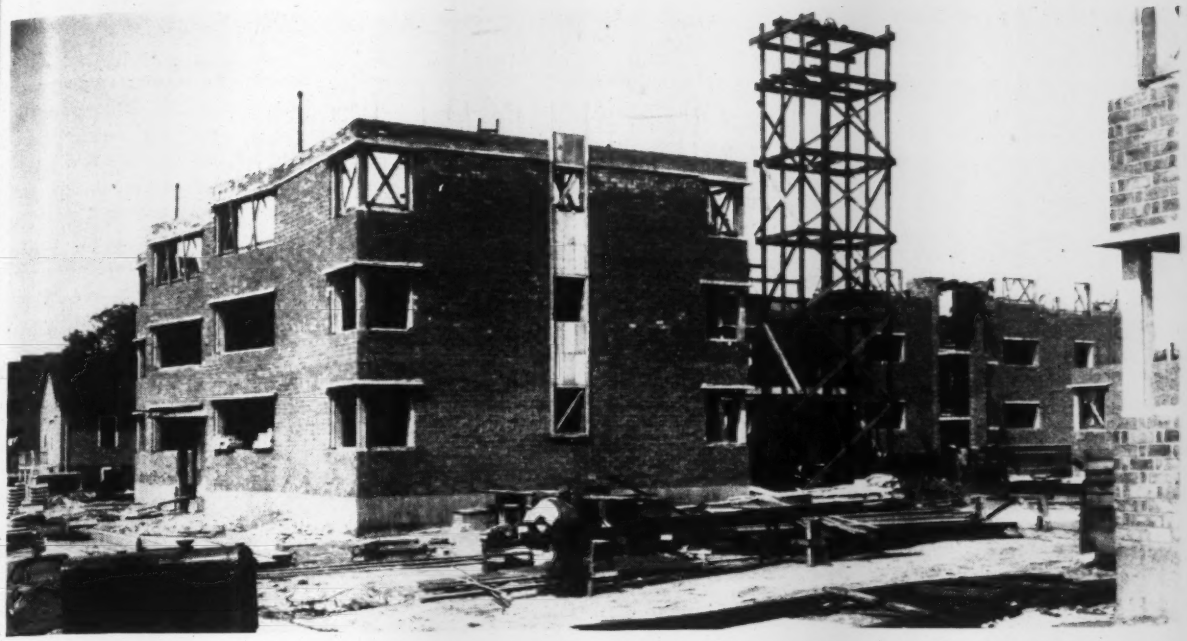


Fig. 1. Reinforced brickwork of the exterior walls of a housing development in Chicago was designed to span openings and eliminate need for steel lintels. Precast concrete floor and trim units were used.

Cost-Saving Design Simplified Apartment House Construction

William T. Holsman

Holsman & Holsman and Klekamp, Architects, Chicago, Ill.

***Contents in Brief**—Economies of substantial cumulative amount have been attained in the design of apartment buildings for a Chicago development. By virtue of favorable conditions affecting freedom of design, the architects have been able to make use of advanced technology in the form of features that save space, materials and labor. Reinforced brick walls, a new floor system, and simplified design of other building installations are examples of the cost-saving techniques. All elements of the buildings are integrated into a unified basic design to make the cost savings effective.*

AN ARCHITECT-CLIENT relationship favorable to the introduction of cost-saving ideas gave the designers of apartment buildings for a Chicago project more latitude than usual in departing from familiar, accepted practice. By making wide use of recent technical advances, they produced designs that simplified construction and reduced the cost per room considerably below the average for the region.

Several conditions contributed to the unusual design freedom. The architects worked on a fee basis directly in the interests of the owner-occupants, who are mutual shareholders in the property. This fact relieves the mortgagee of any worry as to the acceptability of the product, and the insurance company that holds the mortgage consequently is willing to give the technicians a free hand. Another important factor was the cooperation of a city building department, which encourages cost-saving techniques by its flexibility and willingness to approve new methods and processes that can be admitted under competent technical interpretation of the building code.

Six four-story walkup buildings of fire-resistant, reinforced-concrete and brick design now are being completed on the first unit of the development, known as the Winchester and Hood Garden Apartments. The structures contain 72 two- and three-bedroom dwelling units, of five and six rooms each. Work has advanced above the foundations for five houses of a second unit. All the buildings exemplify the same basic principles of economic design.

Fundamentally, these principles are simple. They may be reduced to

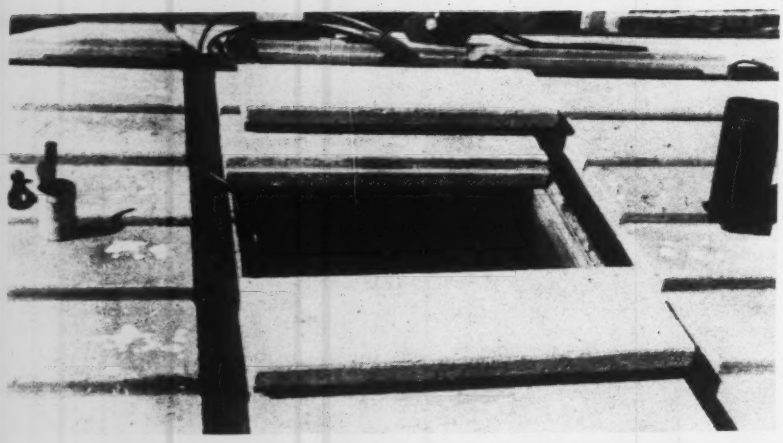


Fig. 2. Radiant heating coils were installed in contact with the flanges of steel box joists supporting lightweight concrete slabs.

Fig. 3. Brick was laid up against a precast window jamb tied to a retractable template, eliminating use of a temporary rough frame. The core of the reinforced wall was filled with cement grout at intervals of three to five courses.

two objectives. One calls for conservation of space, not by sacrificing room size, but by holding the thickness of floors, partitions and walls to a minimum. The second seeks to save material and labor costs by reducing the number of components in specific details, thus eliminating excess operations on the job. Many factors enter into the accomplishment of the two purposes, as the present project makes evident.

Basic design

At the outset, it should be stated that for successful design all cost-saving features to be incorporated in the plans must be determined when the project is conceived. They have to be planned into the building as the design grows. Unless they are thoroughly understood at the beginning, the overall design cannot be integrated in the way that is essential to making the cost savings effective. Furthermore, it is necessary that the plans be developed by professional technicians who are familiar with all design factors. The plans for Winchester-Hood were prepared under conditions meeting these requirements.

Full enumeration of all details of the cost-saving design for this project would be burdensome, but a number of features are of general interest. The buildings have reinforced brick walls; a new floor system of precast concrete slabs and box joists forming a finished ceiling and incorporating radiant heating; precast concrete stair treads, window trim, gable blocks and similar items; 2-in. solid plaster partitions; wardrobe-type storage units with sliding doors; and vertical electrical distribution.

Certain of these features are interdependent; they supplement one another. Thus, in designing the floor system, concrete slabs 3 in. thick, forming a finished ceiling, were developed to save space (Fig. 2). Going a step farther, the designers arranged for manufacture of the slabs by factory methods on a large block machine away from the site. With precast slabs, electrical conduit could not be buried in the floor, and horizontal distribution, therefore, was replaced by a vertical system.

Also tied into the floor design was the use of radiant heating. This method of heating was desired both for economy of operation and for the comfort of the occupants. Application of radiant heating to the buildings was simplified by the design of the floor system. Exposed box joists of the floor system are incased in permanent steel shells, providing a finished surface without use of formwork, and the design made use of the metal boxes as a radiating medium.

Because the steel shells are excellent conductors, they make it possible to reduce the cost of installing efficient radiant heating. By placing the heating coils in contact with the upper flanges of the joist boxes (Fig. 2), 90 percent of the heat in an apartment will be radiated from the ceiling, and thermostatic control will be more positive and immediate than for radiant heat that has to rise through an insulating floor cover. Soft copper tubing is used to facilitate weaving the piping system into the floor pattern and along the top edges of the box joists.

Designing for simplification

Three main lines of approach were employed in design studies to save materials and job labor. The first rule called for simplification of design to reduce the number of what may be called articulations. Additional labor operations are required at every point of contact between construction elements and for every change in direction of any individual element, whether it be a wall or a water pipe.

The plans were drawn with an eye to eliminating as many points of contact and changes of direction as possible.

As a second approach to reduction of material and labor costs, the design made use of many units that could be fabricated by factory production methods away from the site. All precast items—including stair treads, floor slabs, window trim and gable blocks—were produced in this way, as also were the welded steel box joists, with their reinforcement installed in the factory.

For the important third approach to the problem, certain installations that formerly required an excessive number of components and job operations were simplified by redesign of elements and by improvement of erection methods. This type of study was successful, for example, in eliminating some of the materials and operations previously required for installing door bucks, stairs, window trim and floor systems.

Reinforced brick walls

Reinforced brickwork is another result of a cost-saving study of this kind. Its use eliminates the need for expensive steel lintels and speeds erection of the walls. A bricklayer sets 8½ brick to each square foot of wall instead of 13 for an 8-in. wall and 19 for a 12-in. wall, and he lays as many units per hour as for ordinary construction.

All exterior walls are reinforced brick of uniform 8-in. thickness with an allowable load-bearing value of 400 psi. under the Chicago code. The brick were laid on edge with stretchers and headers alternating (the old Chicago bond), and the 3½-in. core of the wall was poured with 2,500-psi. cement grout (Fig. 3). Cement mortar of the same strength was used for bedding the brick. To assure filling the core on this type of construction, relatively new to Chicago, brick was run up only three to five courses (13 to 21 in.) between grout pours. In warm weather, the core was filled at more frequent intervals than in cool weather.

Reinforcement consists of ½-in. vertical rods on 24-in. centers, dropped in the hollow core either before or after grouting, and a ¾-in. horizontal rod at every third course (13 in., c. to c.). Over windows, additional horizontal rods were introduced just above the precast headtrim (of lightweight concrete) to increase the beam strength of the reinforced brick and eliminate need for steel lintels. The precast headtrim, set on a template and used as a form for laying brick above the window, was anchored up into the brick masonry. In the buildings now being constructed, added reinforcement is being used over wall openings for spans up to 12 ft. and also for cantilevering the brickwork over the corner windows (Fig. 1).

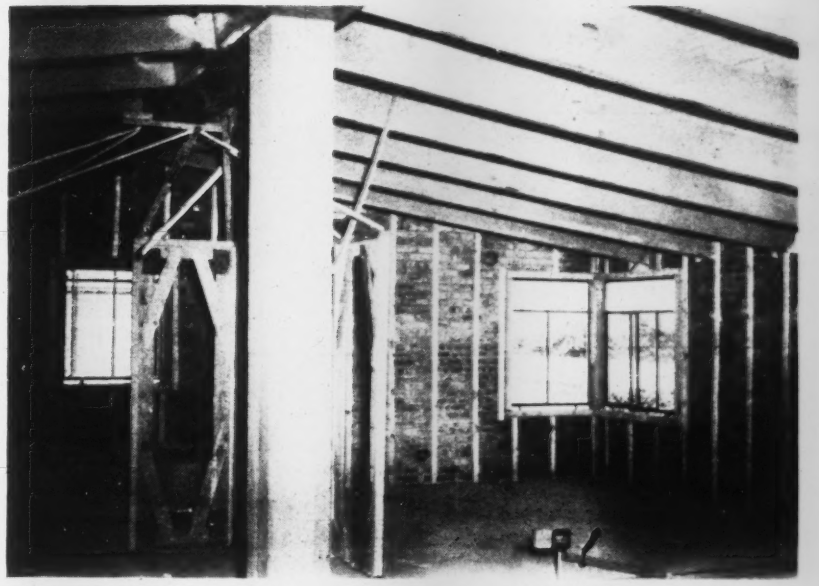


Fig. 4. Exposed steel box joists and acoustical precast slabs form ceilings. Top story under gable roof is shown here. Finished door bucks fitted to precision templates were anchored in position when floor runners were installed.

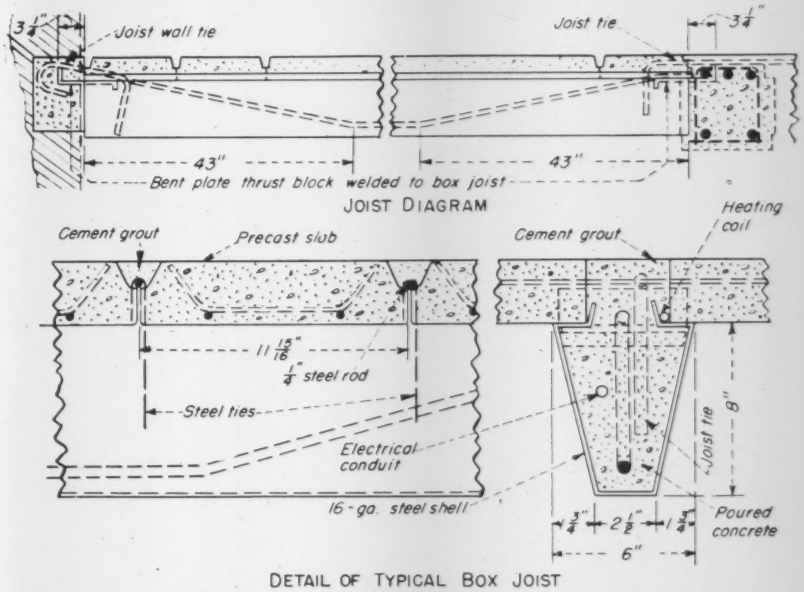


Fig. 5. The floor system of precast 3-in. slabs on steel box joists spaced 3 ft. c. to c., forms an integral unit utilizing the deck as a compression member.

Interior framing of a walkup apartment building, 31 ft. deep, consists of a single line of columns carrying the longitudinal girders of the floor and roof systems. Designed originally for structural steel, the interior frame was changed to reinforced concrete because of the present abnormal cost, due to gray market conditions, of steel shapes. A permanent steel

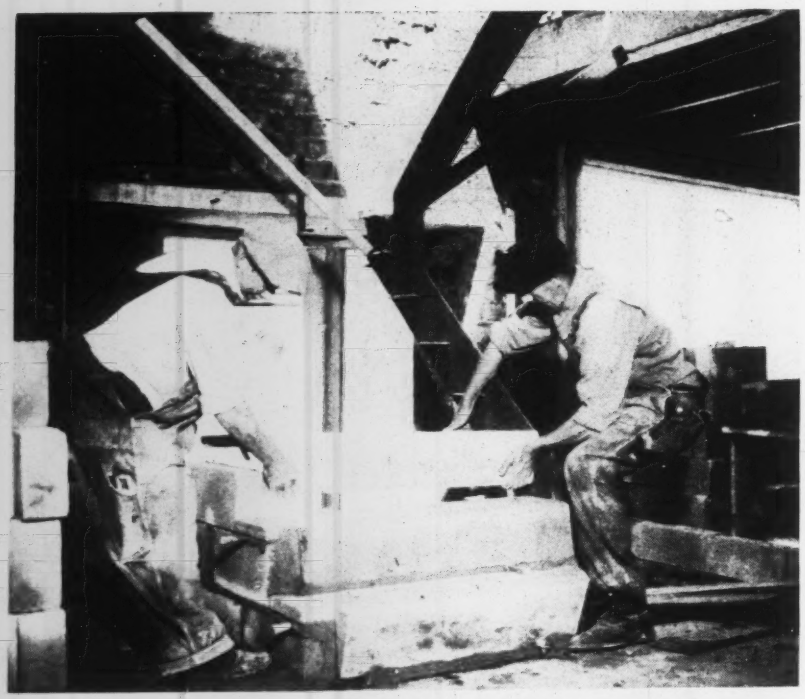


Fig. 6. Precast tread-and-riser units for an inclosed stairway were set by masons as they built the block inclosure wall.

box form being used for the reinforced-concrete girders in the current construction would have been employed in the same way for incasing steel girders. Similar prefabricated steel boxes could be used to advantage for the columns, and they would have been employed if the interior framing had been designed in reinforced concrete from the beginning, but it was inadvisable to attempt to fabricate steel boxes on short notice for the small amount of column formwork on this job.

Floor system

Efforts to save space and reduce costs by designing floors of minimum thickness led to the development of a new floor and roof system, for which patent application has since been made. The system consists of 3-in. slabs of lightweight concrete, 12 x 32 in. in size, supported by steel box concrete joists 8 in. deep, on 36-in. centers (Fig. 2). The concrete mixture used in the slabs is designed to give them a fine porous texture which produces a finished acoustical ceiling with a symmetrical pattern of V-joints between the slabs, every 12 in., running from joist to joist.

Ceiling height to meet code requirements (8 ft. for Chicago) is measured to the underside of the slabs. Joists are exposed on all floors, including the top story, under the gable roof. This type of roof, pitched $2\frac{1}{2}$ on 12 both ways from the ridge girder, avoids the expense and maintenance troubles of parapets.

In the design of the floor system, the joist is utilized as a tension member, and the precast slab deck as a compression member. Tensile stresses in the joist reinforcement and steel box are transferred to "thrust blocks", or angle plates, welded to the ends of the joist at the top of the box (Fig. 5), and the reaction of these end anchorages puts the whole deck into compression when a live load is placed on the floor. The deck is anchored by steel ties to the concrete in the joist boxes and is grouted to form a rigid unit.

Joists are supported at one end in the brick masonry wall and at the other end are framed into the girder. In erecting the floor system, a U-section soffit pan forming the bottom of the girder first was set up on falsework. The prefabricated 16-ga. steel joist boxes, which extend 1 in. into the girder, rested on the flanges of this U-shaped pan. At the outer ends of the joists, the steel box forms were carried on shoring until concrete, placed in the joists and wall pockets, hardened. The angle plates, shop-welded to both ends of the steel joist boxes, protrude into the wall pockets and into the girder (Fig. 5.)

Girder sides were closed by field-welding filler pieces of 16-ga. steel between the joist boxes. Conventional bar and stirrup reinforcement was placed in the girder. The joist reinforcement, previously mentioned, consists of a single bent bar, of a size depending on the span, shop-welded into the steel box unit. This bar takes both tension and shear stresses. The steel box form also helps to resist these stresses.

Anchors in addition to the angle plates were installed at both ends of the joists. In the wall pocket, a bent bar was hooked over a horizontal rod of the wall reinforcement. Across the girder, a U-bar ties the ends of opposite joists together.

Precast floor slabs, laid on the flanges of the steel box joists, formed a working deck for installing heating coils. Top-grooved joints between the slabs furnish a channel for running the copper tubing from one joist to the next (Fig. 2). Light reinforcement of $\frac{1}{4}$-in. rods was placed in these grooves, tying the floor slabs across the joists, and steel ties were dropped over these rods into the joists to anchor the deck to the floor framing members.

When all floor installations were completed, the joists and girders were poured and the slabs grouted, transforming the entire floor system into a rigid unit. Because of the design of the floor system, a monolithic pour was not necessary. Ordinarily the floor contractor filled the girder, joists and wall pockets with concrete and allowed shrinkage to occur before grouting the deck. The sand-cement grout filled the slab joints and the open space between the slab panels over the joists.

Heating system

Efficiency gained by installing $\frac{3}{8}$-in. soft copper coils in contact with the steel joists makes it feasible to heat the apartments with this size tubing on 3-ft. centers. Each apartment has individual flow control of hot water to its ceiling coils, the control being operated by an air-activated thermostat. To maintain a balanced system with equalized pressure on all floors,

the heating circuit is equipped with an upfeed return. At the top of the return loop is an air vent connected by a discharge line to the basement, where the system can be vented occasionally to keep the small-diameter coils from becoming air-bound.

Use of a vertical system for electrical distribution is feasible only where apartments do not have individual metering. On the Winchester-Hood project, vertical wiring was possible because the mutual owners preferred to buy electrical power wholesale.

In each building, the vertical risers are tied back to a distribution box in the basement by horizontal conduits in a 3-in. poured concrete slab on the first floor. This floor, of conventional beam and slab type constructed on steel pan forms, is the only one that does not employ the precast slab and joist system. Heavy feeder lines are hung below the first floor.

Vertical distribution for the electrical system has produced some economies by simplifying installation for the electricians. It also offers operating advantages that outweigh the minor, less desirable feature of having a single fuse for each vertical riser serving individual outlets in four apartments.

Stair design

Precast treads of the inclosed front stairways and the open rear stairways are supported at one end by a 10 x $\frac{3}{16}$-in. steel plate stringer and at the other end by the masonry wall of the stairwell (Fig. 6). The stringers, prefabricated in story heights with clip angles welded on to carry the treads, served as story poles for the brick mason and the floor contractor.

Located in coordination with the wall masonry of the stairwells, stair treads for the inclosed stairways were laid by the masons as they built the supporting 4-in. block walls. Coursing of the block in these walls was designed to fit the stair treads without any cutting of the block. Treads for the inclosed stairways were manufactured with risers attached, in precast units, and joints between units are filled with grout after erection.

For the outside stairways, pockets were left in the exterior brick walls to permit insertion of the treads. No risers were used on these stairways, erected in open wells.

As an aid to good appearance, partitions and party walls are located so far as possible alongside exposed joists and girders. Several details contributed to successful construction of the 2-in. solid plaster partitions.

Partition construction

At the base of the partition, a 1$\frac{5}{8}$ x 2-in. wooden runner was nailed to the concrete floor with case-hardened cut nails. This runner served both as a means of fastening metal lath forming the core of the wall and as a ground for the wooden base.

The bottom fastening was made to a $\frac{1}{4}$-in. horizontal rod supported on nails above the runner. A similar horizontal rod was used at the top, wired to nails driven into the concrete ceiling, except where the lath could be fastened directly to the side of a joist or girder with hard nails. The metal lath was stretched between these rods with tie-wires.

Metal lath used in the partitions is bar-X type with vertical welded stiffeners classified as studs by the building department to meet local code requirements. Vertical stiffeners reduce the amount of horizontal bracing needed. Horizontal 1 x 4-in. bracing strips were wired to the lath on about 4-ft. centers and were left in place until the scratch coat had dried.

Substitution of precut wardrobe storage units with sliding doors in place of conventional closets has effected many savings, one of the most important being in the quantity of plaster partitions required. Solid plaster partitions are used only to form continuous separating barriers to ceiling height between rooms. The wardrobe units fit into the space reserved for closets, and because they are of less than ceiling height, they do away with the costly work of finishing joints at the ceiling line.

Door frames and doors

While the wooden floor runners for the partitions were being placed, the carpenters at the same time erected the finished door bucks, 2 in. deep, which were held rigidly in position by precision templates (Fig. 4). This procedure eliminated the conventional rough door frame and saved the operation of setting it. In a groove provided in the bucks, nails were driven on 12-in. centers on both sides of the metal lath to anchor the door frames to the plaster. Laboratory tests by the U. S. Gypsum Co. have shown this anchorage to be better than any other type.

Plaster is finished flush with the bucks, and the joints are covered with 3-in. half-round casing. In hanging the doors, the carpenters needed to do no trimming, as the doors were prefit and the bucks were designed $\frac{3}{16}$ in. oversize.

Setting of precast window trim was simplified in a similar way to eliminate the temporary installation of a rough frame. By the new procedure, the precast apron was set to grade on the brickwork, and on it was placed a retractable wooden template with adjustable stops set to proper height and width. Precast trim was erected around the template, with the jambs tied to the sides, and the headtrim, in one or more pieces, resting on the top.

Brickwork then was carried up alongside the jambs (Fig. 3) and over the window head, where an additional horizontal rod or two was inserted, as required. After the mortar of the brick masonry had set, the window template was removed. Steel casement windows later were set into reglets provided in the precast concrete trim.

Results of improved design

Values obtained through application of technological advances to cost-saving design may be judged from the fact that the architects for Winchester-Hood in 1926-28 built apartments at a cost of $1,800 to $2,000 a room, while today the same firm is producing superior dwelling units, of equivalent room size, better equipped for comfortable living, at $1,500 a room. These costs, quoted here for a quick comparison, include all improvements to the land, in addition to the cost of the buildings themselves and the carrying charges, but they do not include the costs for organization, sales, promotion and necessary financial reserves.

The Winchester - Hood Garden Apartments were designed and constructed by Holsman & Holsman and Klekamp, as architects, under the direction of the Community Development Trust, with the Trust Company of Chicago as corporate trustee for the mutual owners.

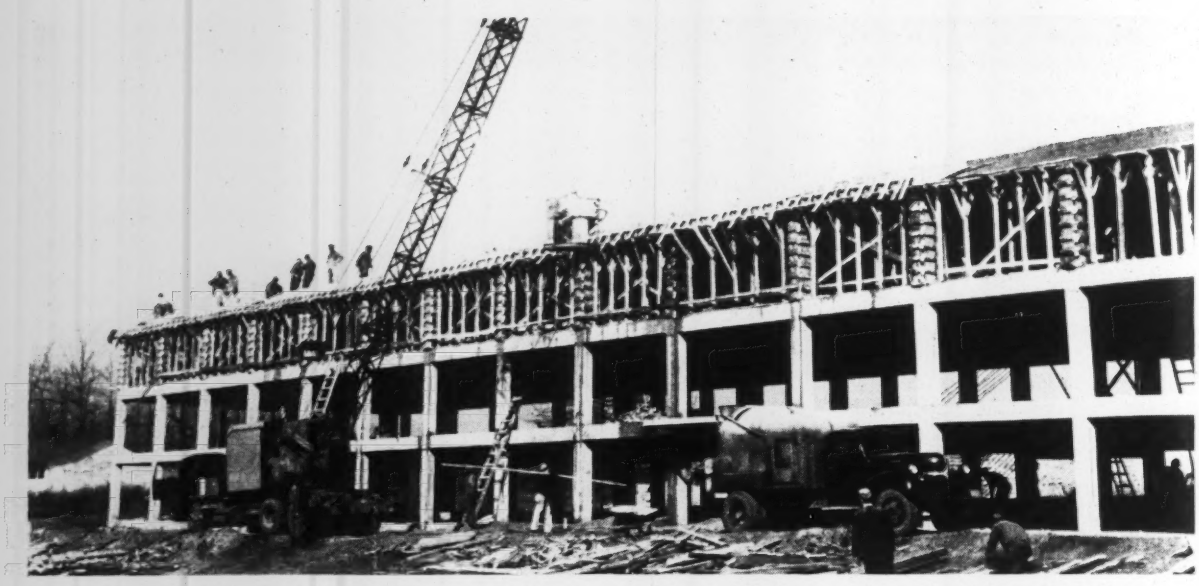


Fig. 1. A major part of the cost of concrete frame construction is building, erecting and stripping of the forms.

Economical Formwork on Current Jobs

Hal W. Hunt
Associate Editor, Engineering News-Record

***Contents in Brief**—New materials and new ideas are combined in details developed by contractors for forms for concrete slabs and columns in multi-story buildings now under construction. Lightweight units for manual handling are a first consideration, with major emphasis in design placed on speed of stripping with maximum reuse.*

DESIGNING, fabricating, erecting and stripping of forms for multi-story buildings are now as thoughtfully planned and as well handled in the field as are products on a factory line. Based on costs and details of previous jobs, but embodying new ideas and modified by availability of materials, forms usually are the product of the best thinking of the job engineer, the carpenter foreman and the superintendents. Forms are planned not for the first use in a structure, but for every use of their expected economic life.

Practically all forms for multiple use are built in well-equipped shops from plans that are as detailed as those for steel erection. Each piece is marked with paint and in very large letters for ready identification in the field, even after wear and exposure. Sections are designed to be handled by hand, and generally are handed up from floor to floor as concrete rises. Columns generally are completely re-assembled at a convenient place and erected as a unit.

Designs emphasize quick assembly and easy stripping, as the aim of form builders is to average a floor a week on concrete frame buildings; and to do a little better some weeks, with floors poured Monday and again Thursday or Friday on the same structure. Stripping and raising material, setting and bracing columns, laying beams and slab bottoms, placing reinforcing and other imbedded materials generally takes three to five days before concrete can again be placed.

Stripping usually is permitted when concrete reaches some specified strength. Most contractors have found it economical to speed this time with high-early-strength cement or added standard cement. Common practice on multiple story housing is to start stripping the morning after the pour, re-posting floors so that no beam or slab takes full load until it has been in place for more than two weeks.

There are constant innovations that permit constructing forms for buildings faster and better, though seldom cheaper than previously because of constantly increasing labor and material costs. Of current importance is coating of plywood with preservatives to protect the edges and faces against abrasion and deterioration from exposure. Overall dipping in lacquer has been found effective. With some laquer coatings, subsequent oiling of the form to prevent sticking of concrete is not required. A special plywood is on the market that has a protective coating of impregnated paper bonded into its surface. It costs substantially more, but users report it economical for repeated applications.

The advent of 3x4-in. timbers sawed at the mill has increased strength of shores at lowered cost. The 3x4-in. size has been used for years, but usually has been ripped from a nominal

size piece so that the section was substandard. Some builders have stopped using wedges under shores and are cutting the posts to the exact length to space the next floor. Damage to posts in removal is eliminated by the simple expedient of cutting a bevel all around at the bottom so that they can be driven out without splitting. Other builders have found wedges economical in the long run and giving more accurate alignment to the finished floor. Supporting floors of steel frame buildings by posting from below requires wedging, of course, to adjust the floor to the steel height.

Spruce is being used quite generally for runners and nailers on reusable forms. It is light, not brittle, and develops greater friction against other members, thus taking best advantage of each nail driven into it.

Details of economical forming operations on several current jobs are reported here. Each has features that its developers feel make it the best type of form for their particular use.

Several of the forms described are on projects of the New York City Housing Authority where many of the buildings are about fourteen stories high. Fourteen uses seem to be about the economical maximum for the light-weight forms. Most of the pictures of these projects were taken at the top floors after twelve or more uses. Some of the plywood shown would be replaced under normal conditions of supply and price, but it now is more expedient to get a few more uses and do more touching up of concrete.

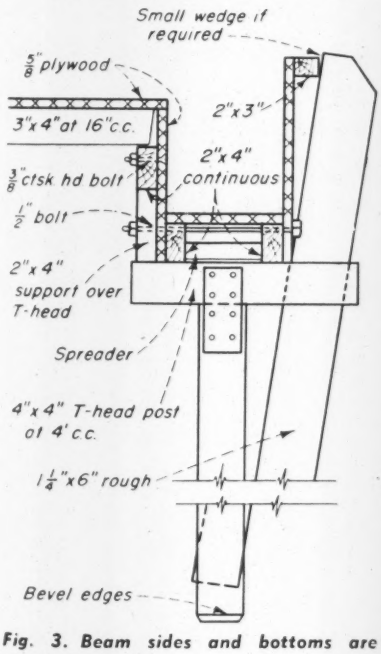


Fig. 3. Beam sides and bottoms are stripped and erected as a unit.

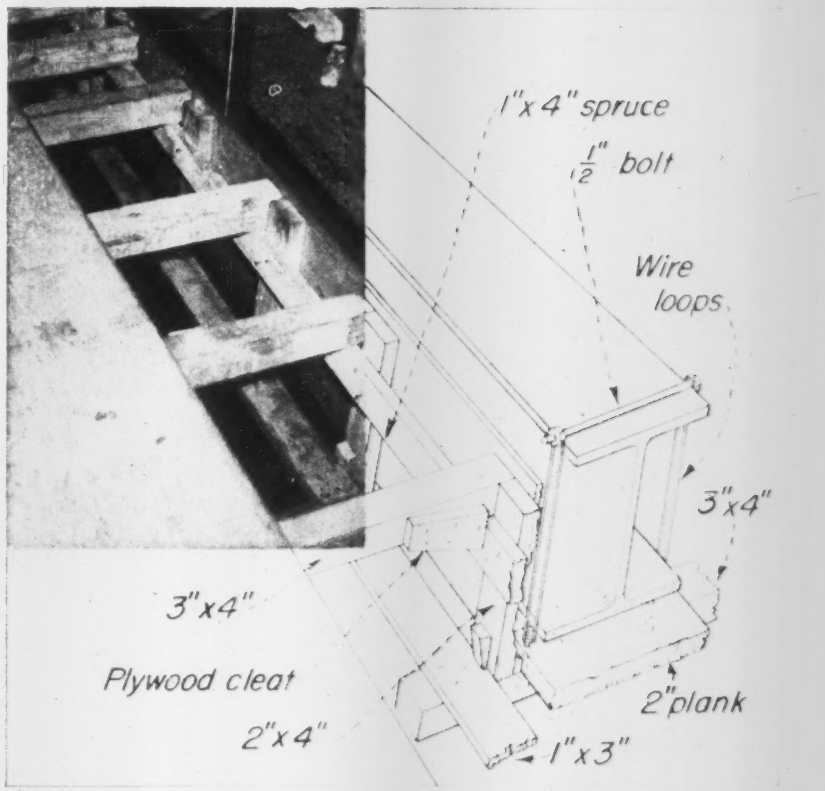


Fig. 2. Wire loop hangers are assembled with beam-bottom form and then raised under beam so that bolt can be slipped through loops, reducing time for erection.

Telephone building in Boston

Typical of forms for floor slabs and fireproofing of multi-story steel-frame commercial buildings is that for the 20-story New England Telephone & Telegraph Co. in downtown Boston being built by Turner Construction Co. Bays in the building are about 20x20 ft. with floorbeams at about 6-ft. centers, supported by deeper beams on the transverse column lines.

Forms for the beam bottoms are hung from the beams and in turn support the beam side and slab-bottom form. Hangers used here are unusual. They are a loop of high-tensile wire with the two ends welded to a tight coil of wire that serves as a connection for a coarse-threaded bolt, inserted from below and passing through a 3x4 that supports the 2-in. beam bottom. The wire does not loop over the beam. Instead, there is a separate wire unit on each side of the beam and these are entirely assembled with the form prior to installation. The form is lifted to position under the beam, a ½-in. bolt is slipped through the loop, and is used to pull the hangers up snug against the flange by tightening the nut. The bolt rests on the beam top and carries the load of the form, which is supported at about 10-in. centers.

Next, preassembled beam sides are set up, made of ¾-in. plywood for contact with the concrete. Beamsides are backed with vertical 2x4's at about 14 in. c. to c., and nailed to the 2x4's is a horizontal 1x4 runner of spruce. The slab form is carried on 3x4's that are spaced at 14-in. centers and lie on the 1x4 runners, but are not nailed. Plywood sheets ¾ in. thick, laid on the 3x4's, are tacked just enough to keep them in place. Stripping is done by backing out the bolts under the beam bottom, thus loosening the entire form.

This method saves the time of threading bolts or wires up through the form while it is being held up under the beam. After the bolts are

Fig. 4. A minimum of pieces, each plainly marked, is achieved in this form developed by Willcox Construction Co.

backed out, the holes can be filled, leaving an excellent surface.

Column forms for fireproof covering are made with ¾-in. plywood, using 2x4 runners vertically backing up the plywood. About eight conventional adjustable column clamps are used to a typical 10-ft. high space between floor and ceiling.

Stripping without dismantling

Forms for beam and slab construction at Jacob Riis development of the New York City Housing Authority on the lower East Side in Manhattan were expensive to build, but are paying off in excellent alignment and reduced finishing costs. Column forms are ¾-in. plywood with 1x2 strips at the proper spacing for clamps. Some conventional clamps are used for large or irregular sizes, but most clamps are of a light-weight double-bar design developed by the builder, Willcox Construction Co., and now used by competing contractors as well. On most jobs columns are held erect by any kind of nailed brace. Here a two-piece brace bolted to the column top is adjustable for length by a bolt working along a metal-protected slot and tightened by a wing nut.

Beam forms are unusual on this job. As can be seen in Fig. 3, the beam sides and bottom are assembled into a rigidly built unit that is stripped and handled in one piece. A unit spanning a bay is set up on the columns and aligned; then T-head posts are set under the form at prepared positions at about 4 ft. c. to c. The slab is supported by 3x4 joists at 16-in. c. to c. with their ends carried on 2x4 runners bolted to the side of the beam form, but primarily supported on vertical 2x4's directly over each T-head post. The 3x4 joists are supported at about 5-ft. intervals by a 4x6 girt that rests on 3x4 posts also at 5-ft. spacing.

For the outside beams a rough sawed 1¼x6 brace provides for alignment of the beam top. Stripping is done with a long, claw-shaped bar that breaks the assembled form loose without dismantling, using a joist as the fulcrum.

Where columns reduce in width along the beam line, for the higher floors, the forms are cut down by ripping the plywood sides. Beam bottoms are extended by slipping 2x4 supports under the beam between existing 2x4 load-carrying members and adding to the plywood surface.

Flat-slab and slab-band forms

Two other housing projects—Amsterdam and Marcy Houses—being built for the New York City Housing Authority by Corbetta Construction Co. illustrate application of similar forming methods to flat-slab and to slab-band construction of multiple-story concrete structures. Forming is somewhat cheaper for the flat-slab design, as is finishing of the smaller area of exposed concrete—but more reinforcing steel is required so the net difference is not large.

Details of the forms used for the flat-slab construction are shown in Fig. 6. Forms for the slab-band construction are similar except that the beam sides are deeper, and there are additional beams.

A new idea in column forms is used on these jobs. Instead of column clamps, 3x4 or larger wood members are used on each side of the plywood form and are held, from outside the

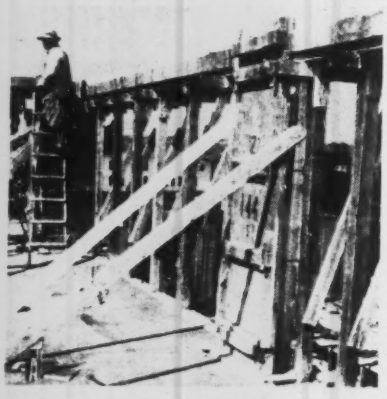


Fig. 5. Clamps have been eliminated in favor of wire ties tightened by wrought wedges on Corbetta Construction Co. column forms.

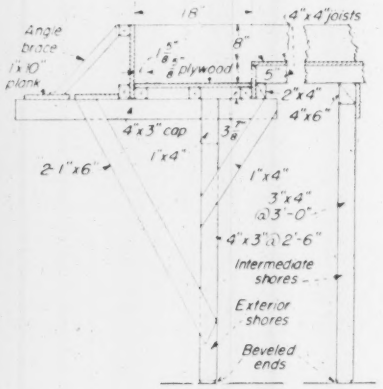


Fig. 6. Form used for flat slab design permits rapid stripping and reerection so that a four-day cycle of use has been achieved.

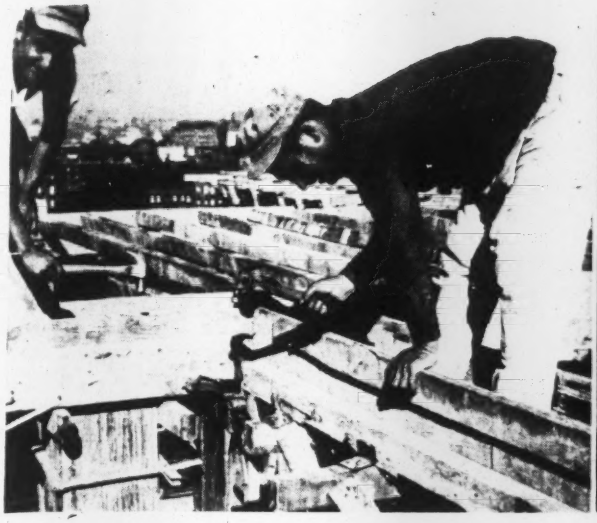


Fig. 7. Forms being placed for 14th floor, are worn but usable. Beam side is being aligned and tightened by wedges backed against metal clip nailed at angle to T-head post.

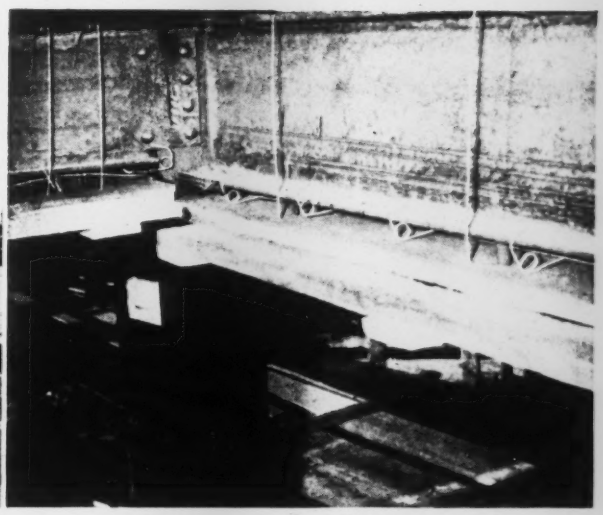


Fig. 8. Hangers of hard No. 8 wire are used to carry beam bottoms on steel frame job. Beam side and slab forms are supported from the beam bottoms.

concrete, by high tensile wires tightened with conventional wire-tire wedges. The concrete columns are the same thickness for the entire height of the structure, but vary in width along the wall. In these forms, the end piece is plywood held against a vertical 2x4 nailed to the inside of the plywood side form. As the columns decrease in width the form at one end is pushed inward and held by "packing" between it and the original vertical member, Fig. 5. This method keeps the form full width at the top and provides support for the full length of the beam bottom required without alteration in the form.

Beam and slab forms

A beam and slab concrete job for the New York City Housing Authority with well planned forms is the 14-story J. W. Johnson Houses on which concrete work is being done by Knickerbocker Concrete Arch Construction Co. Beams are relatively wide. Bottom forms are ¾-in. plywood on 2x4's laid flat and supported on 3x4 T-head posts at 2-ft. centers. Beam sides are ¾-in. plywood, made up integrally with 2-in. nominal thickness lumber that is the right height to carry joists on which plywood decking is laid.

Metal clips nailed to the T-head at an angle, Fig. 7, are used to back wedges that hold the beam sides tight to the bottom. Joists for the slab are 2x4's at 16-in. centers, supported at 5-ft. centers on 4x4 girts carried on vertical posts.

Columns forms are made of ¾-in. plywood held by light-weight column clamps. As column widths reduced, the sides are cut down. This leaves the beam bottom short, a condition that is met by using a slideable metal plate crimped around the beam bottom and arranged to be moved out as required.

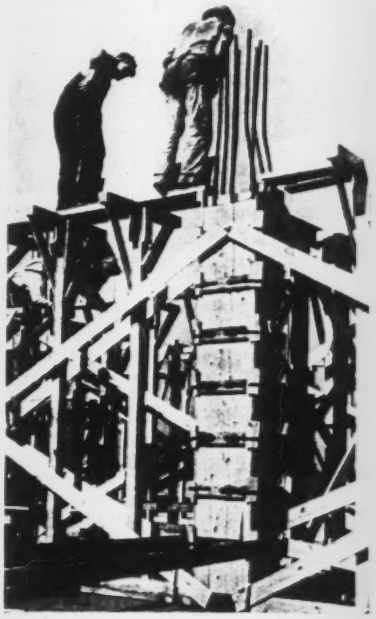


Fig. 9. In South Carolina's pine country 1-in. boards instead of plywood are used for most of the forming. On a Daniel Construction Co. job columns are held by band iron tightened by a wedge at each corner.

The Knickerbocker company also is doing the floors and fireproofing of the 14-story steel-frame Abraham Lincoln Houses. Ties of No. 8 wire crimped over the beams carry beam bottoms of plywood on 1-in. reinforcing lumber, all on a frame built up of 1-in. rough sawed lumber (Fig. 8). Beam sides are plywood, wedged against the bottom member and backed with 1½-in. lumber that carries the ends of dressed 2x4's at 16-in. centers spanning half of a 14-ft. bay. At mid-span the 2x4's are supported on 4x4 girts on 3x4 posts at 5-ft. centers, the posts being wedged from the floor to accommodate variations in the steel.

From Greenville, S. C., comes the interesting column form shown in Fig. 9, from which as many as 20 uses were obtained by Daniel Construction Co. on a Bob Jones University dormitory. Band iron is used to hold the form together with the ends of the horizontal 2x4's cut at an angle and a slope to match wedges driven back of the band. One corner of the form was opened and the others hinged like a wire-bound box so they could be removed and handled as a unit without disassembly.

Use of 14-ga. metal forms for columns of a multiple-story housing development in New York City is described in *ENR* Aug. 21, 1947, vol. p. 273.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Electrosmosis

Sir: Jacob Feld's comments on the "Electrical Stabilization of Soil" (*ENR* July 24, 1947; vol. p. 137) remove the impression that Russian engineers discovered this new application of electric power.

An important reference not included by Mr. Feld is an illustrated article in *Engineering* (London); Feb. 7, 1947, Vol. 163, p. 121.

This describes the use of electrosmosis, under Leo Casagrande's direction, in the construction of German U-boat pens in Norway; also in tunnel construction.

JEROME FEE,
Senior Engineer,
Federal Power Commission,
San Francisco.

Bearing Power of Piles

Sir: The highly informative article on pile driving in your issue of Sept. 4, vol. p. 315 suggests the sounding of a word of caution against using the described piles and driving methods as an excuse for another of these "modernized" imitations that are chisled beyond all limits of reason. We cannot actually look inside the ground into which we drive piles, and sometimes a poor guess is made concerning its value. It is not safe to assume that the ground is exactly the same as the ground on some other job. Even though the driving may be quite similar on two jobs, one job might prove to be entirely satisfactory while the other will fail after being in service for a number of years. Or one part of a building might stand up and another part fail.

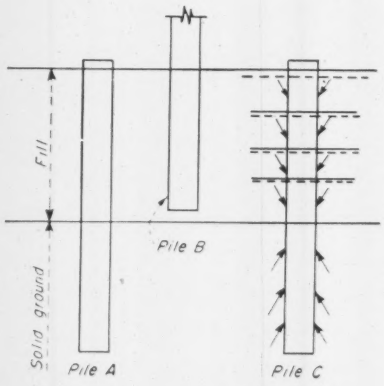
After a pile has been driven, its bearing capacity can be determined by formula or by a load test. That is its dependable load-bearing strength—at the time of the test. But we cannot make a twenty year test or a fifty year test in a part of a day. The piles might be entirely satisfactory for several years and then fail.

As an illustration, see "Pile A" in the sketch. This pile is driven through a deep layer of poor soil and then down deep into good ground until, as determined by formula or by test, it is good for a load of 40 tons. It will safely carry this load and there is no cause for worry—not just yet. But the upper layer of ground is going to settle during the coming years just as well compacted railway embankments and highway embankments continually settle.

During the course of several years, the ground at the top of "Pile A" will subside to some extent, perhaps an inch or two and possibly more. Farther down in the poor soil the settling will be present to a smaller degree. Then the upper portion of pile derives no support from skin friction. Its only load-bearing capacity is then due to its penetration into the good soil below.

"Pile B" is driven partly through the poor soil and then its capacity is determined. Perhaps this is 10 tons—right now, but not forever. And if "Pile B" is withdrawn by a steady pull and no vibration, we have a measure of something else.

"Pile C" shows the future condition that fairly can be expected. Each horizontal element of the fill, shown by full line, has settled to the position indicated by dotted line. No longer is there any beneficial skin friction helping the upper portion of the pile to carry useful load. On the contrary, the fill now rides the pile, the skin friction acting in reverse. And the added load on the pile is somewhat akin to the force required to withdraw "Pile B". The safe bearing value of "Pile C" now is the original 40 tons minus the 10 ton value of "Pile B" and further diminished by perhaps 12 tons of "fill riding". If we accept these figures, this leaves a capacity of only 18 tons. The applied load is 40 tons. So the pile is pushed downward, temporarily relieving the "fill riding" and penetrating farther into the good soil. Future settlement of the upper stratum will develop the "fill riding" again and possibly the pile will be forced down still farther into good soil.



Earth settlement in filled ground may add load far beyond the friction resistance of the pile length in good soil.

Regardless of what we may know or assume concerning the nature of the soil, we should always make sure that the piles are given plenty of hammering. And we should remember that the piles have to hold up the entire costly structure, even though they are down out of sight where the owner begrudges their cost. One safe and sane precaution is the taking of ample borings, as was done in the case of your recent article. After all, it is the owner's ground, and he should feel obligated to tell the engineer exactly what type of ground he has for the support of his building.

LEONARD C. JORDAN,
Consulting and Designing Engineer,
New Rochelle, N. Y.

Airport Employees

Sir: It was recently brought to my attention that in the July 24 issue of *Engineering News-Record* it was erroneously reported (on p. 94) that the Philadelphia Northeast and the Philadelphia Southwest Airport had a total of 97 employees each, giving the impression, although it was not so stated, that they were very inefficiently operated.

In order to correct that impression, I would like to state that the Philadelphia Northeast Airport, which has no scheduled airline operations, has a total of 30 employees at the present time, while the Southwest Airport, which has both scheduled and non-scheduled operations, has a total of 53 employees.

J. VICTOR DALLIN,
Chief, Bureau of Aeronautics,
Philadelphia, Pa.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Asphalt Specifications

CONSTRUCTION SPECIFICATIONS OF THE ASPHALT INSTITUTE—Revised. 300 pp. The Asphalt Institute, New York 17, N. Y. Limited distribution.

These specifications have been developed by the Asphalt Institute's full-time staff with cooperation of engineering committees. They are intended to provide broad general standards of acceptable methods and materials and to serve as a guide to developing more detailed specifications with narrower limits of tolerance for specific jobs.

Drawing With Text-Film

ENGINEERING DRAWING—7th Edition—By Thomas E. French, revised by Charles J. Vierck. 694 pp. McGraw-Hill Book Co., New York 18 and London. $3.75.

Correlation of text and problems with newly developed motion pictures and filmstrips of McGraw-Hill Text-Films is the most notable change in this new edition of a standard engineering drawing text. A brief description of the available text-films is given with each applicable chapter. Pictorial drawing has been developed with new standards and practices in dimensioning, based on advances during the war years. This material makes the new edition a valuable addition to the engineers technical library.

A Study in Earthquakes

WHEN THE EARTH QUAKES—By James B. Macelwane, S. J. 288 pp., 251 illust. The Bruce Publishing Co., Milwaukee. $5.

Written by a professor of geophysics at St. Louis University, this book is primarily a compilation of notes arranged in 17 chapters that discuss the subject from as many angles. In places the notes are only brief outlines but illustrations are profuse, particularly these showing types of seismological instruments. Examples of records made by these instruments are given, maps show the location of widely dispersed earthquake faults and particular attention is given to the San Andreas fault in California. The fact that only sketchy treatment is accorded engineering aspects of the subject indicates that the book is primarily introductory in character. As such, and for those who desire extensive pictorial presentation, the book will be interesting reading.

Mississippi River Floods

SPEEDING FLOODS TO THE SEA—By W. E. Elam. 173 pp. The Hobson Book Press, 55 Vanderbilt Ave., New York. $3.50.

In 1933 a new plan of flood control was inaugurated for the lower Mississippi River. The old plan of levees only was changed. For decades the engineers in control of the river had held that the tortuous course of the channel, with all its curves and loops, should be kept inviolate and the spread of flood waters beyond the banks should be restrained by levees. The first considerable modification of the levees-only plan followed the disastrous flood of 1927. Then, in addition to levees, calculated provision was made for side floodways to take the peak of high floods and store the water temporarily until the high level in the main stream had subsided. With a federal appropriation of $328,000,000 work was continued until 1932, building higher and stronger levees and constructing three of the floodways. A landowners suit stopped work on the most important of the floodways. Meanwhile a new theory of flood control had gained advocacy among federal engineers. This involved a straightening of the channel by artificial cut-offs across important loops, an added outlet to the Gulf and detention reservoirs on main tributaries. As stated, the new plan was inaugurated in 1933 and has now been implemented by a score of cut-offs, detention reservoirs and other structures.

The monograph by Mr. Elam is a sketchy story of flood conditions, flood fighting and flood protection on the lower river since the earliest times. More particularly it is a documented account of his pioneering work in advocating the new plan of flood control. It is in no sense a definitive history of that plan and its prosecution. This remains to be written. As a record of source material it has definite value. *Reviewed by* C. S. HILL, *associate editor (retired), Engineering News-Record, Long Branch, N. J.*

Depreciation Accounting

ANATOMY OF DEPRECIATION—By L. R. Nash. 214 pp. Public Utilities Reports, Inc. Munsey Bldg., Washington 4, D. C. $5.

The stated purpose of this book is to present a history of the development of depreciation accounting by public utilities, then to summarize the present conflicting views relating to future procedure, all supplemented by such available facts and forecasts as may be helpful in pointing the way to a reasonable solution.

Although the author favors a general description of depreciation accounting as "an orderly method of providing for the retirement of property" and recognizes that provision should be made for premature retirements due to storms, etc., he contends that such provision does not imply existing depreciation.

Mr. Nash visualizes two distinct depreciation accounting procedures. One plan assumes that the progress of depreciation can be determined with needed accuracy and that the accumulation of current provisions therefore represents existing depreciation. The alternative plan, which the author favors, assumes that there is a lack of definiteness and regularity in the incidence of depreciation, that its accumulated amount can be determined with greater accuracy, and that the maintenance of the required reserves through adjustable current charges is the logical final step instead of the initial one.

A large portion of this book is devoted to a discussion of service lives. The various statistical methods in general use are reviewed. Mr. Nash recognizes with reservations the usefulness and importance of service lives when tempered by judgment.

The author discusses, but in the writer's opinion not entirely objectively, the "straight-line" and "interest" methods—the views of the courts, regulatory bodies, industry

and others as to their relative merits and limitations. If the procedures in "straight-line" depreciation accounting were so inflexible and mathematically precise as imputed to be, "straight line depreciation" would be deserving of the criticism Mr. Nash has leveled at it. Mr. Nash favors the "sinking-fund" method with an undepreciated rate base and interest credits to the reserve at rates comparable to the prevailing yields of senior securities.

For the "straight-line" method the author would substitute the "reserve-size" method. All of the claimed advantages of this method are inherent in the "straight-line" method when it is properly applied. In the "reserve-size" method a depreciation reserve is maintained with maximum and minimum limits. As the upper limit is approched the credits to the reserve are reduced and conversely as the lower limit is approached the credits are increased.

It should be stated that much of what at first might seem to be factual is actually the author's opinion or conclusion with which many students and experts in the field of depreciation accounting will not agree. Whether or not this treatise will be "helpful in pointing the way to a reasonable solution"—its expressed objective—is a moot question as apt to be as controversial as the subject of depreciation accounting itself.—*Reviewed by* WILLIAM R. WOLFF, *associate hydraulic engineer; Public Service Commission, State of New York, New York.*

Compressed Air

COMPRESSED AIR HANDBOOK—387 pp. Compressed Air and Gas Institute, New York 6, N. Y. $3 in U.S.A.; $3.50 elsewhere.

Much very useful information on production, distribution and use of compressed air and gas is scattered through the profusely illustrated pages in this first industry wide book on compressed air. Most of the air tools and equipment used by the construction industry are described with suggestions for applications.

A large section of the book is devoted to engineering the compressor plant for maximum efficiency, with detailed suggestions for planning, selecting, installing and operating the machines. Intercoolers, aftercoolers, oilers and other supplementary equipment are described. Adequate information is supplied on effect of altitude on compressor capacity and tool efficiency. Tables give friction losses in pipes of various sizes at different pressures and air flows.

A table gives the number of specific tools that can be operated from various size compressors but the book would be much more valuable to construction men if consumption of individual tools could be included, with some reduction factors for multiple use.

Miscellaneous Notes on Booklets and Reprints

REVISED BUILDING CODE REQUIREMENTS for reinforced concrete (ACI Standard 318-47), as ratified by the membership of the American Concrete Institute, are published in the *Journal* of the ACI, Sept., 1947. The standard is written in such a form that it may be incorporated verbatim or adopted by reference in a general building code. Copies are available at 50c. each from the ACI, 7400 Second Boulevard, Detroit 2, Mich.

THE PRESENT STATE OF HIGHWAY TECHNIQUE (L'Etat Actuel de la Technique Routiere, Nouvelle Edition 1947, by Daniel Boutet, Inspecteur General des Ponts et Chaussees) is the roadbuilding manual of France. In 561 pages, its twelve chapters cover design, construction, materials, maintenance and financing. It is published by Science et Industrie, 6 Ave. Pierre Premiere de Serbie, Paris (16), France.

A NEW DIGEST OF STATE LAWS governing the practice of engineering and land surveying and of state board procedures has just been published by the National Council of State Boards of Engineering Examiners. Much of the information is compiled in tabular form for ease in comparing the requirements of the several states. The main tables are accompanied by a full statement of footnote references for each state. Copies of the digest can be obtained from T. Keith Legare, executive secretary of the Council, P. O. Drawer 1404, Columbia, S. C., for $2.

CALIFORNIA AIRPORTS is the title of a 444-p. report containing a multitude of statistical data pertaining to airports in California. Because it describes all existing airports in the state and gives economic data pertaining to possible revenue sources for existing and projected flying fields, it should be a valuable reference for engineers engaged in airport work. Issued by the California State Reconstruction & Reemployment Commission, it can be obtained from the Printing Division, Documents Section, 11th & O Sts., Sacramento 14, Calif., for $5 plus tax.

New Engineering Books

HANDBOOK OF ENGINEERING—4th Edition—By L. A. Waterbury. 386 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $2.50.

CONSTRUCTION SPECIFICATIONS OF THE ASPHALT INSTITUTE—Construction Series No. 80. 303 pp. The Asphalt Institute, 801 Second Ave., New York 17. Limited distribution.

PRACTICAL DESCRIPTIVE GEOMETRY—By S. E. Rusinoff. 259 pp. American Technical Society, Chicago 37, Ill. $3.50.

FLUORESCENT LIGHTING MANUAL—2nd Edition—By C. L. Amick. 318 pp. McGraw-Hill Book Co., New York 18, and London. $4.

SCIENTIFIC BLACKSMITH—By Mortimer E. Cooley. 290 pp. University of Michigan Press, Ann Arbor, Mich. $3.

COMPRESSED AIR HANDBOOK—387 pp. Compressed Air and Gas Institute, New York 6, N. Y. $3. in U.S.A.; $3.50 elsewhere.

Reports and Pamphlets

A YEAR BOOK OF RAILROAD INFORMATION—1947 Edition—Eastern Railroad Presidents Conference, Committee on Public Relations, 143 Liberty St., New York 6.

DEVELOPMENT OF HIGHWAY CONSTRUCTION AND MAINTENANCE EQUIPMENT—Bulletin No. 117. American Road Builders' Association, International Building, Washington 4, D. C.

LIMITATIONS IN CROSS-LAMINATING OF OAK UNDER EXTREME SERVICE CONDITIONS—Engineering Experiment Station Series No. 66.—By E. G. Stern. Virginia Polytechnic Institute, Blacksburg, Va.

MAINTENANCE METHODS FOR PREVENTING AND CORRECTING THE PUMPING ACTION OF CONCRETE PAVEMENT SLABS—Current Road Problems No. 4-12. Highway Research Board, 2101 Constitution Ave., Washington 25, D. C. 30c.

(*Continued on page 220*)

IN *Empire* METERS ALONE

YOU GET A *double-barreled* APPROACH TO METERING SATISFACTION

• There are two reasons for Empire meter accuracy, sensitivity and long life: first, correct design; second, accuracy in construction.

In design, these meters are patterned around the simple, time-proven Empire oscillating piston principle that for over 63 years has had no equal.

In manufacture, we have pioneered the use of the latest in automatic production equipment to assure sound castings, precise machining to hair-splitting tolerances and exacting test.

Empire meter users gain marked benefits from our two-way approach to their metering satisfaction. These benefits translate dollarwise into increased revenue with negligible repair expense over the years.

Remember: Empire meters cost less because they measure more.

PITTSBURGH EQUITABLE METER DIVISION
Rockwell Manufacturing Company
Pittsburgh 8, Pa.
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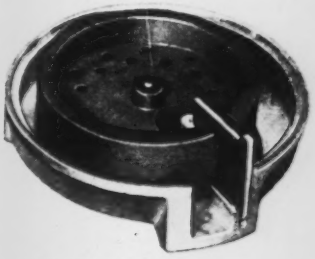
1



CORRECT DESIGN

Here's a view of the famous Empire balanced piston in the bottom half of the two-part measuring chamber. Because the web of this piston is centered to equalize pressures above and below it . . . . and because of its feather weight, the piston practically floats between the mirror-smooth faces of the chamber. Thus friction and wear, the common causes for early inaccuracy and repeated repairs, are reduced to a minimum.. Accuracy is assured throughout years of service.

2

PRECISION MANUFACTURE

Illustrated is one of several automatic boring machines that are used to internally finish the mating parts of Empire measuring chambers. Tolerances are rigidly held to .0003" on the depths and .0005" on the diameter. Other equally accurate automatics precisely turn the exterior surfaces and those of the balanced oscillating piston that operates within.

EMPIRE Type 12 METER
Frostproof model for cold climates
Described in bulletin W-902
EMPIRE Type 14 METER
Bronze bottom plate model for warm climates
Described in bulletin W-901

EMPIRE *Oscillating Piston* METERS

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
December Materials and Labor Prices will appear in the December 11, 1947 issue.
Mexico City, Mexico prices will be published in this section of Engineering News-Record each month.

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block	CONCRETE Ready Mixed 1:2:4 mix per
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg. 50 c.y.	
Atlanta	$3.87	$3.07	$2.82	....	....	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	....	$10.05
Baltimore	3.66	2.86	2.61	$2.10‡ft	$2.10‡ft	1.60‡ft	2.25‡ft	2.35‡ft	2.20‡ft	2.20‡ft	.145	$0.145w	8.55
Birmingham	3.42	2.57	2.32	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.15	.15	6.95
Boston	4.13	3.33	3.08	1.50‡t	1.50‡t	1.40‡t	1.25‡t	1.35‡t	....	....	.186	.195w	9.40v
Chicago	3.65	2.85	2.60	2.60‡d	2.60‡t	2.85‡t	2.60‡d	2.60‡d	2.00‡	2.00‡	.20	.20x	....
Cincinnati	3.69	2.89	2.64	1.70‡bb	1.70‡bb	1.60‡bb	2.75‡bb	2.75‡bb	....	....	.17	.195	9.00kk
Cleveland	3.69	2.80	2.50	1.90llt	1.65llt	1.25ll	3.20‡h	3.20‡h	2.45	2.45	....	.20	10.40ss
Dallas	3.57	2.72	2.47	1.80	1.80	1.60	1.89	1.99	....	....	.0775p	....	8.08
Denver	4.03	3.23	2.98	1.85	2.00	1.15	....	....	....	....	.2245	.2245w	9.25
Detroit	3.54	2.74	2.49	2.75‡	2.75‡	2.50‡	2.75‡	2.75‡	2.75‡	2.75‡	.17w	.18w	8.30kk
Kansas City	3.65	2.85	2.60	1.85	1.85	1.40t	1.45q	1.45q	....	....	.16wf	.175ay	9.35n
Los Angeles	3.50eehn	3.00hn	2.60hn	1.65‡t	1.75‡t	1.55‡t	....	1.65‡t	....	....	....	....	8.75n
Minneapolis	3.85kkd	3.05kkd	2.80kkd	2.00h‡j	2.00h‡j	1.10h‡j	2.10h‡j	2.10h‡j	....	....	.19cco	....	9.65jjo
Montreal	....	2.17r	2.02r	1.78hhs	1.78hhs	1.10s	.95cs	1.05cs	....	....	.1391	.1515w	7.75ii
New Orleans	3.43	2.58	2.33	1.82	1.82	1.62	....	....	.90	1.15	...	....	9.92
New York	4.75‡	3.75‡	....	1.85de	1.85de	1.30de	1.90de	1.90de	....	....	.16/.18ff	.16/.18eeccii	9.90k
Philadelphia	3.52‡	2.72‡	2.47‡	2.20‡	2.30‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.20/.22	.20/.22w	9.25
Pittsburgh	3.51	2.66	2.41	1.90‡	1.90‡	2.20‡	2.35‡	2.35‡	1.90	1.90	.22z	.22z	9.85
St. Louis	3.62v	2.82v	2.57v	2.25‡oh	2.25‡oh	2.00/2.25‡oh	1.35c	1.35c	....	....	.195	.22yo	10.15
San Francisco	3.91y	3.04	2.64	1.71	1.71	1.81	1.81	....	....	....	....	.25y	9.80x
Seattle	3.35rr	3.10	2.80	2.50‡od	2.50‡od	2.50‡ol	3.00‡od	3.00‡od	....	....	.18o	....	8.75o

‡ Delivered. *a* F.o.b. truck at plant. *b* 20c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. car or truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* 8% sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* Does not include dealer's commission. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* 5 tons or more. *cc* Also 8 x 8 x 18-in. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y. lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for.

* Prices include dealer's commission except where indicated to the contrary.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 25c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.05*	$2.05*	Universal, Pa.	$2.10	$2.10
Hannibal, Mo.	2.10	2.10	Northampton, Pa.	2.00	2.00	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.10	2.10	Richard City, Tenn.	2.10	2.10	Montreal City (Discount 10c. per bbl. 20 days)	1.88	1.88
			Steelton, Minn.	2.20	2.20			

* Destination price base effective Aug. 14, 1947

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	....	$0.074	....	$0.0806h	....	$0.0781	$0.0806	....
Baltimore	150.00‡	52.70‡	....	15.00	$21.00	.0775	$0.1075	13.00	$23.00	.10	.10	$0.14
Birmingham	....	32.00	....	....	....	....	....	....	....	....	....	....
Boston	85.00	59.00	3.75	17.00o	29.50o	.0723o	.1447o	.075ho	.15ho	.07o	.0907o	.18o
Chicago	150.00‡y	72.00/74.00e‡	2.97/4.10d‡	18.00/19.00b	28.00/28.50b	17.50bg*	25.50/26.00bg	.085/.0875bh	.17/.1725bh	.0675/.07b	.0925/.1025b	.14/.165b
Cincinnati	....	....	....	19.40z	....	....	....	....	....	....	....	....
Cleveland	186.52	47.00t	3.50	24.50	36.00	24.50g	36.00g	.105h	.24h	.11	.135	.24
Dallas	l	40.00	l	16.95	29.15	.0686	.1225	20.00	37.60	.05	.0675	....
Denver	....	38.00	....	....	....	....	....	23.50	....	....	....	....
Detroit	....	63.00x	....	20.00	26.00	18.40g	24.40g	.0811h	.128h	.075	.1085	.1522
Kansas City	....	40.00	....	17.60	....	16.00g	....	.075h	....	.0675	.09	....
Los Angeles	l	....	l	12.50bf	....	....	....	13.00b	....	.04b	.10b	.20b
Minneapolis	....	....	2.39d	23.00	32.00	17.00g	28.00g	23.00	33.00	.08	.09	.15
Montreal	100.00	....	....	16.60k	24.25k	11.60kp	14.85kp	11.50kp	13.50kp	.08kj	.135k	.188k
New Orleans	....	....	....	15.50a	.....s	13.50gn	.....s	6.75a	.....s	.055	.08	.13n
New York	....	....	2.50d	20.95	31.35	19.95g	37.79g	.0868h	.1632h	.0818	.0866	.1608
Philadelphia	150.00	62.00	4.06	19.00	....	17.00g	....	.08h	....	....	....	....
Pittsburgh	142.00	42.00	3.90	20.00	30.00	.10	.20	22.00	34.00	.08	.09	.18
St. Louis	....	43.50	.....	16.50/17.00	22.50/23.00	15.50/16.00y	21.50/22.00y	.075/.08h	.165/.17h	.065/.07	.075/.095	.125/.155
San Francisco	....	54.00c	....	13.00	26.50w	13.00g	....	13.50	....	....	.0575	.1275
Seattle	....	....	....	13.00i	27.00i	11.00ig	....	13.50i	17.50i	12.50ig	.0575i	.0725i

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2¾ x 8½ x 4 in. *l* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–300 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums. *k* Tax included. *l* Not used. *n* 55 gal. drums. *o* Price at plant. *p* Per 100 gal. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *z* 50–300 penetration. * Price ranges from $17.50 to $18.00.

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES-PLATE/	REINF. BARS billet *be*	RIVETS ½-in. structural *f*	WIRE NAILS Base *df*	SHEET PILING Base *f*	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES *f* Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.80	$2.75	$5.65	$4.25	....	$55.00	$62.00	Not	$3.25	$4.85	$3.05	$7.00
Chicago	2.80	2.75	5.65	4.25	$3.30	.....	.....	avail-	3.25	4.85	3.05	7.00
Pittsburgh	2.80	2.75	5.65	4.35	3.30	55.00	62.00	able	3.25	4.85	3.05	7.00
Buffalo	2.80	2.75	....	....	3.30	.....	.....	....	....	....	3.05	....
Cleveland	....	2.75	5.65	4.35	....	.....	.....	....	....	....	....	....
Youngstown	....	2.75	....	....	....	.....	.....	....	....	4.85	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.975‡	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.44/3.47‡	3.325‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Lebanon, Pa., Richmond, Va. and Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone. *d* Add switching charge $18 per CL. lengths. Add 50¢ for cut lengths. *e* Mill *f* Per 100 lbs.

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price.
Atlanta	$5.02‡	$5.12‡	$5.12‡	$.025	$.10	$31.00	$33.00	....	....	....	....
Baltimore	4.48	3.96*l*	....	....	.10	33.50	35.50	$2.40	$1.66	$2.52	$4.25
Birmingham	4.10	4.25	4.25	.05	.10	37.50*p*	40.50*p*	....	....	....	....
Boston	4.92‡	4.65‡	4.096*a*	....	.10/.15	29.00	31.00	2.48	1.71	2.60	3.753*k*
Chicago	4.40	3.65*ff*	3.65*ff*	.05	.05	27.00‡	29.00‡	....	....	....	3.30*i*
Cincinnati	4.79‡	3.819*e*	3.819*e*	....	....	.2900*eeqq*	31.00*eeqq*	....	....	....	3.644
Cleveland	4.65	3.54†*c*	....	....	.10	29.00	31.00	....	....	....	....
Dallas	6.72	5.50	5.50	....	....	29.15	31.35	....	....	....	....
Denver	....	5.62*e*	....	....	....	40.00*s**	45.50*qs**	....	....	....	....
Detroit	4.77‡	4.691	4.691	....	.10	33.00*x*	35.00*q*	....	....	....	3.512*q l*
Kansas City	5.15*ee*	4.31†*aak*	4.31†*aak*	....	.10	34.00	36.00	....	....	....	3.78*k*
Los Angeles	5.30*f*	4.43	4.28	.03	.05	30.50	32.50	....	....	....	....
Minneapolis	4.78‡	4.984*ccn*	4.984*ccn*	....	.15	29.50*k*	31.50*k*	....	....	....	3.817*k*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*h*	38.70*h*	....	....	....	73.00*jd*
New Orleans	....	4.63*ok*	....	.05	.10	27.50	29.50	....	....	....	.....
New York	4.52*r*	4.50	....	....	.15/.20	30.00*st*	32.00*st*	2.44	1.68	2.56	3.35*i*
Philadelphia	4.52	4.59	....	....	....	30.00‡	32.00‡	2.41	1.67	2.53	3.41
Pittsburgh	4.40	4.55	4.55	.05	.10	26.00	29.80	2.24	1.56	2.35	5.05
St. Louis	4.699‡	3.87*c*	3.87*c*	....	.05	38.00‡	40.00‡	....	....	....	....
San Francisco	5.10	4.53	....	....	....	32.50	34.50	....	....	....	4.85
Seattle	3.628*e*	4.58†*e*	....	....	....	43.00*w*	46.00*w*	....	....	....	4.355*dl*

‡ Delivered. *a* Mill prices. *b* 1-5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢, ¾ in., ⅞ in. 15¢, ⅝ in. 20¢, ½ in. 35¢, ⅜ in. 55¢, ¼ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *qq* Unchanged since Sept. comparable Aug. std. diamond mesh price was $26. std. ribbed, $28. † Price includes quantity and size charge but no switching charge. * Previous prices also on LCL. Std. diamond mesh prices were unchanged at $36. from Jan. thru Oct. 1947.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14-41 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *s*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$79.78	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	50.7	36.2	46.7	31.7
Baltimore	84.10	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	54.4	39.9	50.4	35.4
Birmingham	74.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	....	50.7	36.2	46.7	31.7
Boston	86.70	392*usx*	.756*usx*	3.465*usy*	8.7125*usy*	150.60	233.40	1.03*jcc*	2.75*jcc*	52.7	38.2	48.7	33.7
Chicago	85.06	54	1.04	4.12	12.80	150.00‡	270.00‡	.65	2.25	56.5*t*	42.0*t*	51.5*t*	36.5
Cincinnati	83.86	406	.783	4.00	12.00	155.00‡	240.00‡	.60	2.25	54.9	40.4	50.9	35.9*t*
Cleveland	85.54	.329*x*	.6345*x*	2.79*x*	7.38*x*	135.50	212.00	.58	2.25	57.15	42.65	53.15	38.15
Dallas	87.28	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	48.8	34.3	44.8	29.8
Denver	92.12	.38*dd*	.68*dd*	2.84*dd*	....	.....	.....	.64*dd*	2.25*dd*	46.9	32.4	42.7	27.7
Detroit	85.54	.455	.8775	3.69	8.50	170.00‡*m*	260.00‡*m*	.50	1.90	55.4	40.9	51.4	36.4
Kansas City	86.62	.39*m*	.705*m*	2.78*m*	6.85*m*	175.00*m*	310.00*m*	.50*t*	1.70*t*	52.2	37.7	47.8	32.8
Los Angeles	98.50	.414†	.894†	3.77‡	9.689‡	188.38‡	313.20‡	....	....	....	....	....	....
Minneapolis	88.60	.51*mo*	.98*mo*	3.95*mo*	....	.....	.....	1.05*h*	2.90*h*	52.3	37.8	47.9	32.9
Montreal	78.20	.68*s*	1.20*s*	3.94*s*	6.38*es*	.48*pss*	.68*pss*	72.00*jkss*	218.00*jkss*	....	....	....	....
New Orleans	82.18	.40	.72	3.06	....	220.00*bb*	.....	.55	1.95	50.3	35.8	46.3	31.3
New York	83.30	.59	1.09	4.24	10.79	.....	.....	1.00	2.25	53.7	39.2	49.7	34.7
Philadelphia	81.70	.50	.95	3.95	9.75	220.00‡	275.00‡	1.05*h*	2.75*h*	54.2	39.7	50.2	35.2
Pittsburgh	86.02	.357*m*	.6585*m*	2.70*m*	6.625*m*	126.20	197.40	1.05*h*	2.50*q*	57.5*t*	42.0*t*	53.5*t*	38.5*t*
St. Louis	83.38	.40	.72	2.88	6.53	.....	.....	1.10*il*	2.15*hl*	54.1	39.6	49.2	34.2
San Francisco	98.50	.4375*d*	.7875*d*	3.15*d*	7.875*d*	159.00*dl*	265.00*dl*	.69	2.85	....	....	....	....
Seattle	100.30	.45*b*	.81*b*	....	....	72.50*c*	.....	.595	1.80	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL. Burlington, N. J. (base) $79.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¾ in., 8½c.; 1 in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city. *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60-1941 specifications used.. *aa* No standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck. ** Recent 10% emergency freight rate increment granted railroads on Oct. 13 not included.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld —1 in. and 1¼ in. black, 34 galv., 16; 1½ in. black, 38 galv., 18½; 2 in. black, 37½, galv., 18. Lap weld —2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade		PLYWOOD Rail freight increment (See note for base sizes)	
	All Fir planks No. 2 common. Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)									2x12 *Rgh*	12x12 *Rgh*	⅜"	½"
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 *Rgh*	6x12 *Rgh*	12x12 *Rgh*				
Atlanta	**$72 00**	**$72 00**	**$62 00**	**$62 00**	**$62 00**	**$62 00**	**$82 00**	.....	.....	.....	.....	**$20.46**	**$24.67**
	85 00	*85 00*	*95 00*	*95 00*	*95 00*	*95 00*	*85 50*	*$85.50*	*$85.00*	.....	.....	.....	.....
Baltimore	**86 80**	**88 00**	**88 00**	**86 80**	**90 20**	**94 60**	**104 50**	.....	.....	176.00	165.00	20.96	25.58
	96 80	*99 00*	*102 30*	*101 90*	*105 40*	*108 40*	*116 00*	*110.00*	*110.00*	.....	.....	.....	.....
Birmingham	**87 50**	**87 50**	**87 00**	**86 00**	**87 00**	**90 00**	**110 00**	.....	.....	110.00	112.50	19.97	24.37
	92 50	*92 50*	*92 00*	*91 00*	*92 00*	*95 00*	*114 00*	*97.00*	*98.00*	.....	.....	.....	.....
Boston	**70 00**[3]	**72 00**[3]	**66 50**[3]	**68 50**[3]	**70 50**[3]	**74 50**[3]	**70 25**[3]	.....	.....	.....	.....	20.96	25.58
	64 75[3]	*64 75*[3]	*62 75*[3]	*63 25*[3]	*62 75*[3]	*62 75*[3]	*60 50*[3]	*59.50*[3]	*59.50*[3]	*59.50*[3]	*59.50*[3]	.....	.....
Chicago ‡	**50 00**	**94 00**	**83 00**	**83 00**	**83 00**	**90 00**	**90 00**	.....	.....	115.00	115.00	17.16	20.90
‡	*98 00*	*98 00*	*80 00*	*80 00*	*80 00*	*95 00*	*95 00*	*95.00*	*95.00*	.....	.....	.....	.....
Cincinnati	**89 00**	**91 00**	**90 00**	**88 00**	**90 00**	**92 00**	.....	.....	.....	100.00	135.00	19.97	24.37
Cleveland *k*	**110 00**	**120 00**	**120 00**	**115 00**	**120 00**	**125 00**	**125 00**	.....	.....	125.00	125.00	20.35	24.86
k	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*130 00*	*128.00*	*125.00*	.....	.....	.....	.....
Dallas	**59 00**	**59 00**	**56 75**	**57 75**	**59 00**	**61 50**	**61 00**	.....	.....	94.75	91.00	17.16	20.90
Denver	*95 00*	*95 00*	*96 50*	*96 50*	*96 50*	*96 50*	*105 00*	*110.00*	.....	.....	.....	12.76	15.57
Detroit	**86 00**	**86 00**	**86 00**	**86 00**	**86 00**	**88 00**	**88 00**	.....	.....	88.00	105.00	19.97	24.37
	98 00	*98 00*	*92 00*	*92 00*	*93 00*	*95 00*	*100 00*	*100.00*	*105.00*	.....	.....	.....	.....
Kansas City *a*	**103 00**	**110 00**	**103 00**	**103 00**	**103 00**	**103 00**	**110 00**	.....	.....	115.00	120.00	15.18	18.48
	105 00	*110 00*	*110 00*	*110 00*	*110 00*	*110 00*	*115 00*	*110.00*	*115.00*	.....	.....	.....	.....
Los Angeles *a*	*87 50*	*87 00*	*85 00*	*85 00*	*85 00*	*85 00*	*90 00*	*100.00*	*90.00*	.....	.....	12.27*gh*	14.91*gh*
Minneapolis ‡*b*	107 00[8]	107 00[8]	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.18	18.48
‡*b*	*108 00*	*108 00*	*108 00*	*108 00*	*108 00*	*105 00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Montreal *e*	69 00	70 00	64 00	68 00	70 00	75.00	.....	.....	.....	.....	.....	.....	.....
	97 00	*97 00*	*97 00*	*97 00*	*97 00*	*97 00*	*87 00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	**60 00**	**60 00**	**60 00**	**60 00**	**60 00**	**65 00**	**105 00**	.....	.....	100.00	105.00	17.16	20.90
	61 00	*61 00*	*58 50*	*56 50*	*58 50*	*54.50*	*60 00*	*60.00*	*90.00*	.....	.....	.....	.....
New York ‡	**100/105**	**100/105**	**Range from $95 00 to $99 00**				**120 00**	.....	.....	.....	.....	20.96	25.58
‡	.....	.....	*Range from $110.00 to $120.00*				*110/120*	*115/125*	*115/125*	.....	.....	.....	.....
Philadelphia	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	.....	.....	150.00	150.00	20.96	25.58
	120 00	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	**59 40**	**61 80**	**71 35**	**63 60**	**69 45**	**73 10**	**84 85**	.....	.....	130.60	141.00	20.68	25.19
	72 60	*76 70*	*74 70*	*78 90*	*78 80*	*74 85*	*91 35*	*96.85*	*96.96*	.....	.....	.....	.....
St. Louis ‡*j*	**100 75**	**100 75**	**102 50**	**101 00**	**102 00**	**105 00**	**107 00**	*132.50*	*132.50*	114.50	108.00	17.16	20.90
‡*j*	*114 50*	*114 50*	*109 50*	*109 50*	*109 50*	*109 50*	*119 50*	.....	.....	.....	.....	.....	.....
San Francisco *d*	*76 50*	*76 50*	*76 50*	*76 50*	*76 50*	*74 50*	*74 00*	*74.00*	*74.00*	.....	.....	9.24*g*	11.28*g*
Seattle	*70 00*[6]	*70 00*[6]	*70 00*[6]	*70 00*[6]	*70 00*[6]	*70 00*[6]	*75 00*[6]	*75.00*[6]	*75.00*[6]	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [3] Spruce. [6] Western Pine, No. 3 Common. [8] Norway Pine. ‡Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truckload in Greater Cleveland. Less 2% for cash. Truck lots.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $151.00; on ⅜", $171.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50

* Freight rates include 10% emergency increase granted railroads on Oct. 13.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946 — Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	76%	76%	$0.195	
Baltimore	70-10%	71-10%	.195	
Birmingham	68%	68%	.15	
Boston	77%	78%	.195	
Chicago	68%*e*	68%*e*	.195	
Cincinnati	67&10%*a*	67&10%*a*	.195	Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%
Cleveland	67-10-10%	67-10-10-10%	.235	
Dallas	67%*e*	68%*e*	.2075	
Denver	68%	68%	.20	
Detroit	77%	76%	.195	
Kansas City	68-10%*g*	68-10%*g*	.20	
Los Angeles	63%	68%*h*	.2025	
Minneapolis	68%	68%	.20	
Montreal	40-5%*ab*	40-10-5%*ab*	.....	
New Orleans	68%	68%	.205	
New York	73%	74%	.265*f*	
Philadelphia	69%	70%	.195	
Pittsburgh	77-10%	77-10%	.1675	
St. Louis	70-10%	70-10%	.20	
San Francisco	66%	73%	.20	
Seattle	59%	60%	.2025	

a Discount from list, Sept., 1939; sales tax included, but 6% tax exemption not allowable for. *b* Single thickness. *d* Discount from jobbers list Sept. 15, 1928. *e* Discount from list of Jan. 29, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $9.00 per ton. *g* Discount from list of Aug. 15, 1938. *h* Single thickness. Double thickness 67%.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C. L. 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 – 1625	.18 – .1925	.20 – .2125
Rocky Mtn. States	.155 – 1675	.18 – .1975	.20 – .2175
Pacific N. W. States	.1525 – .165	.1825 – .195	.2025 – .215
Pacific S. W. States	.15 – .1575	.18 – .1875	.20 – .21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in. — 2-ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in. — 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in. — 2-ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in. — 3-ft. from butt	5-in.	91 to 100-ft.	....	.62
14-in. — 2-ft. from butt	6-in.	50 to 69-ft.	.41	.69
14-in. — 2-ft. from butt	6-in.	70 to 79-ft.	.43	.61
14-in. — 2-ft. from butt	5-in.	80 to 85-ft.	.54	.63
14-in. — 2-ft. from butt	5-in.	85 to 89-ft.	.57	.64
14-in. — 2-ft. from butt	5-in.	90 to 100-ft.	....	.68

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	.....	2.50/2.60*a*	....	3.40/3.55*a*
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	2.25	3.05*ag*	3.00	4.15*ag*
St. Louis	White Oak	1.80	.....	2.50	.....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	.....	.....	.....
San Francisco	Douglas Fir	1.50*ef*	2.70*f*	2.00*bf*	3.78*caf*
Montreal	Birch or Maple	....*h*	....*h*	....*h*	....*h*

Tr. — Treated; Untr. — Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *g* January, 1943 price, none later available. *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. delivered	.07 – .12
Calcium chloride, 77-80%, flaked, 100-lb. paper bag, del'd, ton	24.00-40.50
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags	1.15-1.30
Sulphate of copper, in bbl., per 100 lb.	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M, lots of 2,000 pieces or over. 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M, lots of 2,000† pieces or over. 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M, in quantity Common backing	Straight hard	LIME Per ton, in paper, carload lot. Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$16.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	24.00*c*	32.00*c*	30.00	18.00	2.75*m*
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*f*	22.50*f*	21.80	17.50	
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00††	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	20.00	24.00	25.00	18.00	.....
Cincinnati	120.00*j*	135.00*j*	170.00*jdd*	280.00*j*	.....	.....	33.00	41.00	25.60	23.20	.....
Cleveland	99.50*cc*	106.00*cc*	197.50*cc*	.....	.....	.....	25.50	25.50	21.15	19.15	22.15*ee*
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	
Denver	.....	.....	.....	.....	.....	.....	26.00	31.00	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	126.00	134.00	252.00	285.00	370.00	423.00	26.00*f*	28.00*f*	28.00	26.00	26.00
Kansas City	.....	.....	.....	.....	.....	.....	16.00	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	20.00	21.00	24.00		25.00
Minneapolis	144.00*p*	160.00*p*	.....	160.00*mp*	.....	.....	23.50*p*	.....	33.00*bb*e	24.00*bb*e	33.00*bb*e
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*aq*	.....	294.40*a*	22.16	31.86	12.50*ab*	14.00*a*	8.00*aq*e
New Orleans	160.00	160.00	300.00	380.00	411.89	485.91	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*c*	166.70*hn*	.....	.....	28.00	.....	33.50	25.50	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	26.75	17.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	28.00*q*	19.40	16.90	2.85*m*
St. Louis	106.92	119.30	220.71	231.57	287.28	319.20	28.50*al*	26.50*s*	72*aaap*	55*aaap*	82*aaqee*
San Francisco	124.00	139.50	186.00*dd*	139.50*f*	.....	.....	27.50		23.10	23.10	2.31*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*eaw*	.....	.....	28.50	33.50	27.95*e*	27.95*e*	3.28*me*

i F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *f* Includes $3.50 per M for truck delivery. *g* 5½ x 8 x 12. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x-7½ x 12. Speed tile. *o* Per bbl., 200 lb. *p* Truck lots. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* f.o.b. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select.

PAINT, ROOFING — F. O. B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Graphite *b*	Per gal., drums Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.85	$27.375	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	18.60	27.00	2.25	3.50	2.75	2.50	3.00	3.00	.50	30.00
Birmingham	18.85	27.375	4.40	4.32	....	2.84	2.70	2.70	.40	34.50
Boston	18.60	27.00	1.75	2.50	2.31	2.00‡*h*	3.30‡*q*	3.30‡*q*	.25‡	21.00
Chicago	18.60	27.00	....	....	....	2.50‡	2.63‡*o*	2.65‡*o*	....	31.00‡
Cincinnati	18.60	27.00	....	3.15	1.90	2.21	2.26*o*	2.26*o*	.37	34.00
Cleveland	18.60	27.00	3.00	3.00*a*	3.00	2.21	2.26*o*	2.26*o*	.31*y*	33.00
Dallas	18.60	27.00	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	18.60	27.50	2.88	4.38	2.63	2.04*o*	2.24*o*	.....	.42	32.00
Detroit	18.60	27.00	2.25	3.00	2.00	2.25	2.25	2.25	.50	25.00
Kansas City	18.60	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	.....
Los Angeles	18.85	27.50	2.80	4.00	3.50	2.98	2.19*e*	*l*	.77	*l*
Minneapolis	18.60	26.13*m*	....	....	....	2.10*him*	2.15*him*	2.15*him*	.37*m*	28.00*hm*
Montreal	.....	17.85	2.90*p*	4.20*p*	3.62*p*	2.85*t*	2.58*tf*	2.07*tf*	.68*t*	1.85*kt*
New York	18.60	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30*s*	26.00
Philadelphia	18.60	27.00	1.75/2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.60	27.00	1.98	2.50	1.90	2.32	2.37*o*	2.37*o*	.37	31.00
St. Louis	18.60	27.00	....	....	....	2.66	2.66	2.66	.38	29.00
San Francisco	18.85	27.25	1.80	2.75*n*	1.35	2.27*x*	3.30*ux*	.....	.38*y*	.....
Seattle	18.85	27.50	2.95*m*	2.95*m*	....	3.00*mq*	3.07*hm*	....	.48*m*	35.00*ym*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb per square. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *u* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Electrical Workers	Steam-fitters	Common Labor — Building	Common Labor — Heavy Const.
Atlanta	$2.00	$1.65	$2.00	$2.00	$2.00	$1.80	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.15	2.20/2.40	2.00	2.00	2.00	1.10	1.10
Birmingham	2.25	1.625	1.90	1.60/1.875	2.00	2.00	2.00	.85	.95
Boston	2.15	1.90	2.00	2.25	2.25	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.15	2.15	1.50	1.50
Cincinnati	2.25	1.975	2.10	2.00	2.125	2.125	2.125	1.25	1.15
Cleveland	2.25	2.125	2.25	1.875/2.125	2.125	2.125	2.125	1.55	1.40
Dallas	2.00	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95/1.50
Denver	2.25*b*	1.875	1.875*b*	1.875*b*	2.25	2.05	2.05	1.275	1.35
Detroit	2.25	2.025	2.25	2.25	2.25	2.25	2.165	1.425	1.425
Kansas City	2.25	1.90	2.05	2.125	2.25	2.025	1.875	1.325	1.325
Los Angeles	2.25	1.90	2.25	2.00	2.50	1.875	2.00	1.25	1.25
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	1.9375	1.625	1.875	1.75	1.875	2.00	2.05	.90	.90
New York	2.75*b*	2.50*b*	2.75	2.75*b*	3.00*a*	2.25*a*	2.75*b*	1.50	1.50
Philadelphia	2.40/2.50	2.00	2.40	2.25	2.25	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.40	2.25	2.25	2.25	1.30	1.30
St. Louis	2.25	2.20	2.25	2.40	2.25	2.25	2.25	1.35	1.50
San Francisco	2.25	2.00	2.25	2.00	2.25	2.25	2.25	1.40	1.40
Seattle	2.235	1.935	2.135	1.95	2.235	2.135	2.345	1.535	1.45
Montreal*	1.40	1.06	1.11	1.00	1.17	1.11	1.11	.73	.97

a ¢ Hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage.

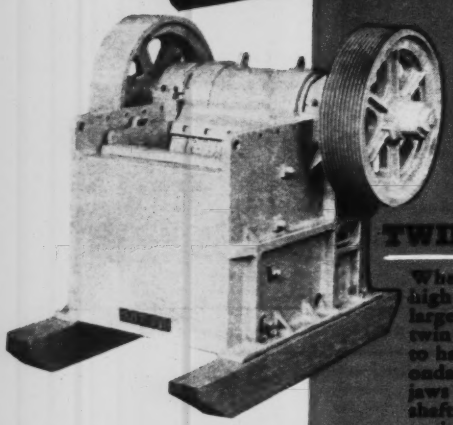
MEXICO CITY PRICES

In Pesos, F.o.b. City		Sept. '47	Oct. '47
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3"-15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods			
⅜" x 12 meters	per ton	1,000.00	1,000.00
½" x 12 meters	per ton	955.00	955.00
⅝" x 12 meters	per ton	940.00	940.00
¾" x 12 meters	per ton	940.00	940.00
⅞" x 12 meters	per ton	930.00	930.00
1" x 12 meters	per ton	925.00	925.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	35.00	33.00
Rose Gravel	per tr. load	32.00	28.00
Cement, Std. Port. (Tolteca)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	370.00	370.00
1st Class Pine	per M ft.	750.00	750.00
2nd Class Pine	per M ft.	450.00	450.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.120. **ENR Common Average:** $1.260

5 RIGHT ANSWERS
...to your crushing problems!
5 CEDARAPIDS CRUSHERS

PRODUCT OF IOWA

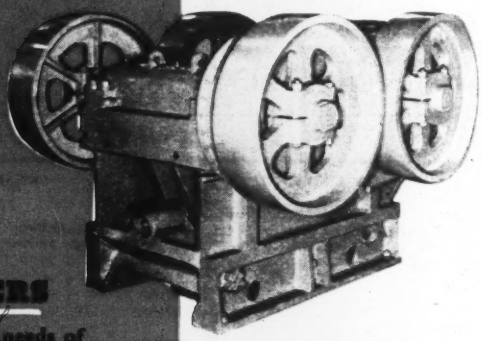


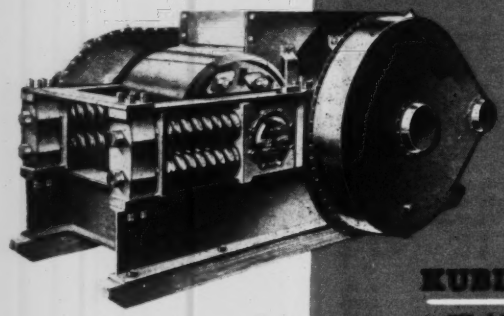
JAW CRUSHERS

Engineered in every detail for smooth, steady performance, lower maintenance and operating costs, and extra capacity. There's a complete range of sizes for primary and secondary crushing in all types of portable and stationary plants.

TWIN JAW CRUSHERS

Where there is an unusually high percentage of crushing of larger sized gravel, a Cedarapids twin jaw crusher may be used to handle the primary and secondary crushing. Two movable jaws operated by two eccentric shafts provide much greater capacity and smoother operation.



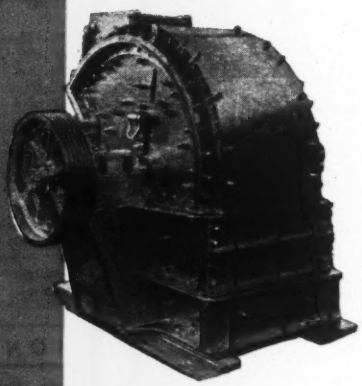


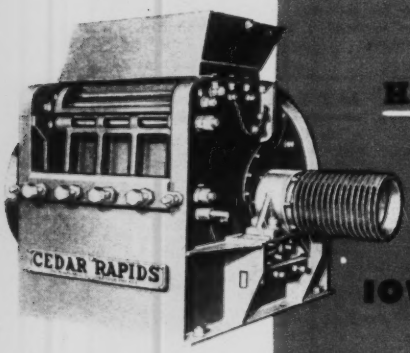
ROLL CRUSHERS

Seven sizes to fit your needs of larger production of smaller sized aggregates at lower cost. Available with two smooth, or two corrugated roll shells or with one of each depending upon finished product desired. Exclusive shear plate protection for shaft and bearings.

KUBIT IMPACT BREAKER

"Kubitized" aggregate with its uniformly angular surfaces, makes much stronger concrete, bituminous, or macadam construction. Hammers mounted on a rotor knock the stone against breaker bars breaking the stone along its natural lines of cleavage. Available in 4 sizes.





HAMMERMILLS

Cedarapids Hammermills will produce either crushed limestone up to 1½" size or agricultural lime, or a percentage of both, depending upon the setting of the grates and the speed of the rotor. Offered in 3 sizes, and in complete portable combinations as well.

IOWA MANUFACTURING COMPANY
CEDAR RAPIDS, IOWA

Cedarapids — Built by IOWA

The Iowa Line *of Material Handling Equipment Includes*

ROCK AND GRAVEL CRUSHERS
BELT CONVEYORS—STEEL BINS
BUCKET ELEVATORS
VIBRATOR AND REVOLVING SCREENS
STRAIGHT LINE ROCK AND GRAVEL PLANTS
FEEDERS—TRAPS
PORTABLE POWER CONVEYORS
KUBIT IMPACT BREAKERS
DRAG SCRAPER TANKS
WASHING PLANTS
TRACTOR-CRUSHER PLANTS
STEEL TRUCKS AND TRAILERS
PORTABLE STONE PLANTS
PORTABLE GRAVEL PLANTS
REDUCTION CRUSHERS
BATCH TYPE ASPHALT PLANTS

For details on Cedarapids crushers, ask for Bulletin CC-1 or see your nearest Cedarapids dealer.

Building Trades Wage Rates—8-Hour Day

(Prevailing September 1, 1947.—Compiled by Engineering News-Record)

City and State	Carpenters	Bricklayers	Structural Ironworkers	Common Labor Buildings	Common Labor Heavy Constr.	Stonemasons	Mason's Helpers	Plasterers	Mosaic and Terrazzo	Tile Layers	Cement Finishers	Lathers	Electric Workers (Inside)	Painters	Glaziers	Plumbers	Steamfitters	Roofers	Waterproofers	Sheet Metal Workers	Welders	Hoisting Eng. 1-Drum	Hoisting Eng. 2-Drum	Tractor Operator (Over 30-hp.)	Power Shovel Operator	Truck Drivers (Over 1½ Tons)
Anderson, Ind.	$1.75	$2.00	$2.13	$1.20		$2.00	$1.35	$2.00	$2.00	$2.00	$1.75	$1.88		$1.50	$1.50	$1.90	$1.90	$1.50	$1.50	$1.50		2.10	$2.10	$1.90	$2.10	$1.25
Atlanta, Ga.	1.65	2.00	2.00	.75	$.85	2.00	.85	2.00	2.00	2.00	2.00	2.00	$1.80	1.63	1.40	2.00	2.00	1.50	1.50	1.65	$1.75	1.50	1.75	1.75	1.68	1.00
Austin, Tex.	1.63	2.25	1.88	.75	.75	2.25	.65	2.50	2.25	2.25	1.50	1.50	2.00	1.63	1.13	2.00	1.88	1.25		1.75	1.75	1.25	1.50	[a]1.50	1.50	[b]1.00
Baltimore, Md.	1.95	2.50	2.15	1.10		2.25		2.00	2.00	2.00	1.90	1.90	2.00	[c]1.78	1.60	2.00	2.00	1.50		2.00		1.75	2.20	[d]1.58	2.20	[e]1.15
Baton Rouge, La.	1.63	2.00	2.00	.80	.90	2.00	.95	2.00	2.00	2.00		2.00	2.00	[f]1.50	1.50	2.00	2.00	1.45	1.45	1.63	2.00	2.00	2.00	2.00	2.00	1.10 [g],[h]
Birmingham, Ala.	1.63	2.25	1.90	.85	[i].95	2.25	[i].95	2.00	2.25	1.75	1.88	[j]1.88	2.00	[k]1.88	1.63	2.00	2.00	[l]1.40	[m]2.00	1.73	[m]2.00	1.60	1.88	1.88	1.88	1.75
Bismarck, N. D.	1.45	2.00	2.00	[n]1.00	[n]1.00	2.00	1.00	1.75		2.00	1.50	1.45	1.65	[o]1.50	1.45	1.65	1.65	1.35	1.35	1.85	1.50	1.50	1.75	1.50	1.75	1.00
Boise, Idaho	1.63		1.85	1.15	1.15	2.00	1.50	2.00			1.75	2.00		[p]1.50		2.00	2.00	1.63		1.85	1.75	1.50	1.60	1.60	[q]2.00	1.25
Boston, Mass.	1.90	2.15	2.00	1.40	1.40	2.15	1.40	2.00	2.00	2.00	2.00	2.00	2.15	1.88	1.70	2.00	2.00	1.82	2.00	1.90	[q]2.00	2.25	2.25	1.80	2.25	1.25
Buffalo, N. Y.	2.00	2.25	2.15	1.40	1.40	2.10	1.69	2.15	1.98	1.98	1.98	2.15	2.15	1.88	1.85	2.15	2.15	2.05	1.90	2.00		1.99		[r]1.65	2.03	1.40
Burlington, Vt.	1.50	[s]2.15	[t]1.10	[u]1.00	[t]1.00	1.75	[t]1.15	1.75	1.75	1.75	1.75		1.50	1.25	1.25	1.50	1.50	1.75		2.50	[v]1.35			1.75	1.75	[t]1.15
Charleston, S. C.	1.50	2.00	1.75	.60	.60	2.00	1.00	1.75	2.00	2.00	1.50	1.75	1.75	1.50	1.50	2.00	2.00	1.75		1.75	1.50	1.50	1.50	1.00	1.50	.81
Charleston, W. Va.	1.88	2.25	2.00	1.13	1.13	2.25		1.88	2.05	2.05	1.75	1.88	2.00	[w]2.00	1.68	2.00		1.50	1.50	1.80	2.00	2.00	2.00	1.75	2.00	1.23
Charlotte, N. C.	1.40	1.75	1.75	.75	.75	2.00	.85	1.75	[x]1.75	1.75	1.50	1.75		[y]1.25	[z]1.00	2.00	2.00	[aa]1.40	1.50	1.65	[z]1.25	1.25	1.50	[ab]1.25	1.50	1.00
Cheyenne, Wyo.	1.70		1.70	[t]1.10	1.15			2.00			1.75	1.85	1.75	1.70		1.88	1.88			1.88	1.85		1.70	1.85	1.85	1.25
Chicago, Ill.	2.15	2.20	2.20	1.50	1.50	2.20	1.50	2.23	2.15	2.15	2.15	2.23	2.15	2.15	2.25	2.15	2.15	[ac]2.20	2.20	2.15	2.20	2.15	2.15	1.85	2.45	[t]1.30
Cincinnati, Ohio.	1.98	2.25	2.10	1.25	1.15	2.25	1.50	2.13	2.13	2.13	1.88	2.00	2.13	1.88	2.05	2.13	2.13	1.75	1.90	1.90	1.75	2.00	2.00	[ad]1.43	2.00	1.04
Cleveland, Ohio.	2.13	2.25	2.25	1.50		2.00	1.50	2.13	2.00	2.00	2.00	2.13	2.13	2.00	2.00	2.13	2.13	2.18		2.00		2.00	2.00		2.13	1.40
Columbus, Ohio.	1.88	2.00	2.13	1.18	1.18	2.25		2.13	1.25	1.63	1.88	2.08	1.95	1.75	1.38	2.00	2.00	[ae]1.50	1.50	1.88	2.13	1.75	1.75	1.43	2.00	1.25
Concord, N. H.	1.38	2.00	1.80	1.00	1.00	2.00	1.05	2.00			2.00	1.50	1.50	1.15	1.38	1.50	1.50			1.50		1.50	1.50	[af]1.10	1.90	1.05
Conway, Ark.	1.25	1.88		.65	[t].75	1.88	1.00	1.88			1.50	1.88	1.88	[ag]1.25		1.75	1.75	1.50	1.50	1.50						
Dallas, Tex.	1.88	2.25	2.00	.95	.95	2.25	1.10	2.13	2.13	[ah]2.13	1.88	2.13	2.00	1.88	1.63	2.13	2.13	[ai]1.73	1.63	2.00	2.00	1.75	2.00	2.00	2.00	[t]1.25
Denver, Colo.	1.88	2.25	1.88	1.28	1.75			2.25	2.15	2.15	2.00	2.25	2.05	1.75	1.70	2.05	2.05	1.88	1.88	1.88	1.88	1.88	2.00	1.88	2.00	1.38
Des Moines, Iowa	1.80	2.13	1.93	1.20	1.20	2.13	1.30	1.97	1.75	1.75	1.80	2.00	2.00	1.63	1.50	2.00	2.00	1.30 $.10	1.30	1.83	*	1.75	1.90	1.75	1.90	1.25
Detroit, Mich.	2.03	2.25	2.25	1.43	1.43	2.25	1.43	[aj]2.25	2.13	2.13	1.88	2.25	2.25	1.95	1.75	2.17	2.17	2.00	1.88	2.03	*	2.00	[ak]2.25	2.00	2.00	[al]1.55
Duluth, Minn.[20]	1.65	1.90	1.75	1.15	1.25	1.90	1.00	1.90	1.75	[am]1.75	1.53	1.90	1.88	[an]1.55	1.35	1.75	1.75	1.60	1.25	1.75	[ao]1.75	1.70	1.80	1.70	1.85	1.10
Fort Worth, Tex.	1.75	2.25	1.75	.90	.90	2.25	1.00	2.00	1.88	1.88	1.75	2.25	1.88	1.75	1.50	2.00	2.00	1.75	1.50	1.75	1.75	1.68	1.75	1.75	1.75	1.38
Harrisburg, Pa.	1.58	2.00	2.25	1.00	1.00	2.00	1.25	1.88	1.88	1.88	1.88	1.88	1.75	1.40	1.44	2.00	2.00	1.38	1.38	1.75	*	2.13	2.13	1.75	2.25	1.13
Indianapolis, Ind.	1.98	2.23	2.13	1.18	1.18	2.23	1.40	2.15	1.75	1.75	1.75	1.95	2.10	1.88	1.88	2.10	2.10	1.55	1.88	1.88	2.10	2.10	2.10		2.10	1.55
Jackson, Miss.	1.75	1.88	1.75	.70	.80	2.00	.90	1.75	1.88	1.88	1.75	1.25	1.50	1.25	1.25	1.75	1.75	1.50	1.15	1.38	1.50	1.50	1.50	1.50	1.50	[t]1.00
Jacksonville, Fla.	1.50	2.00	1.75	[m].75	.90	2.00	.80	2.00	2.00	2.00	1.75	1.50	1.75	1.50	1.50	2.25	2.25	1.50	1.50	1.50	1.50	2.00	2.00	[ap]1.25	1.75	.90
Jefferson City, Mo.	1.63	2.00	2.25	1.00	1.00	2.00	1.50	2.00			1.75			1.38		2.50	2.50		1.75	1.75		1.75		2.00	2.00	1.25
Kansas City, Mo.	1.90	2.25	2.05	1.35	1.35	2.00	1.38	2.25	2.00	2.00	1.90	1.95	2.03	1.83	2.00	2.25	2.25	1.75	1.75	2.03	*	1.90	2.13	1.90	2.13	1.15
Little Rock, Ark.	2.00	2.50	2.25	[e].80	[t]1.00	2.50	1.50	2.50		2.50	2.00	2.25	2.00	1.88	1.75	2.50	2.50	2.00	2.00	1.75	2.50		1.75			
Los Angeles, Calif.	1.90	2.38	2.10	1.35	1.35	2.38	1.70	2.25	2.15	2.20	1.98	2.25	2.15	[aq]1.75	1.62	2.25	2.25	1.75	1.75	1.94		1.85	1.85	1.90	2.10	[ar]1.50
Meridian, Miss.	1.50	2.00	2.00	.65	.75	2.00	.75	2.00	1.88	1.88	1.75	1.25	1.65	1.50	1.50	1.75	1.75	1.50	1.15	1.25	1.50	1.50	1.25	1.50	1.25	1.00
Milwaukee, Wis.	1.80	2.00	1.85	1.35		2.00	1.45	2.00	1.90	1.90	1.85	2.00	2.00	1.65	1.85	2.00	2.00	1.70	1.70	1.85	1.85	1.85	1.85	1.80	2.15	1.20
Minneapolis, Minn.	1.80	2.08	2.00	1.30	1.30	2.08	1.40	2.25	1.90	1.90	1.88	2.25	2.06	1.80	1.70	2.00	2.00	1.73	1.73	1.90	*	1.85	1.85	[as]1.85	2.00	[at]1.43
New Orleans, La.	1.63	2.05	1.88	.90	.90		1.00	1.88			1.63	2.00	2.00	1.70	1.63	2.05 $.40	2.05	1.45		1.73	2.05	1.63	1.88	1.88	1.88	.85
New York, N. Y.	[au]2.50	[av]2.75	2.75	1.50	1.50	[au]2.50	[av]1.78	[aw]3.00	2.50	2.50	[au]2.50	[au]2.50	[ax]2.25	[au]2.30	[av]2.50	2.50	[av]2.75	[ay]2.75	[av]2.50	[au]2.75						
Norfolk, Va.	1.50	2.00	1.75	.75	.75	2.00	.85	1.88	1.75	1.75	1.50	1.88	1.80	1.50	1.50	1.75	1.75	[az]1.10	[ba]1.50	1.40	*	1.63	1.88	1.88	1.88	.85
Oklahoma City, Okla.	1.88	2.25	2.00	1.15	1.00	[av]2.00	[av]1.25	2.75	2.00	2.00	2.50	2.75	2.00	2.00	2.00	2.25	2.25	1.50	1.50	1.75	1.60	1.75	2.00	1.50	2.00	1.25
Omaha, Nebr.	1.83	2.10	1.93	1.13	1.13	2.10	1.13	2.00	1.85	[av]1.75	1.83	2.00	2.00	1.50	1.40	2.00	2.00	1.70	1.70	1.75	1.93	1.75	2.00	2.00	2.00	1.13
Philadelphia, Pa.	2.00	[av]2.50	2.40	1.10	1.10	2.13	1.65	2.50	2.13	2.00	2.00	2.25	2.25	[bb]1.90	1.93	2.25	2.25	[bc]1.90	1.90	2.25	*	2.25	2.25	1.88	2.25	1.00
				[b,bd]	[e,bd]	[g,bd]	[y,bd]				[aa,bd]			[b,bd]		[e,bd]	[g,bd]									[b,bd]
Pierre, S. D.	[be]1.50	[e]2.00	1.50	[t]1.00	1.05	2.00	1.00	[bf]1.75			1.60		1.50	1.35		1.75	1.75			[bf]1.25	[bf]1.00			[bf]1.25	[bf]1.50	1.00
Pittsburgh, Pa.	2.25	2.45	2.25	1.30	1.30	2.25	1.55	2.25	2.00	2.00	2.25	2.25	2.25	2.00	1.83	2.25	2.25	2.00	2.00	2.15	2.13	2.30	2.45	2.30	2.45	1.25
Portland, Ore.	1.75	2.10	1.95	1.35	1.35		1.60	2.10		2.00	1.83	2.00	1.88	1.75	1.84	2.13	2.13	1.80	1.80	1.83		1.80	2.05	1.95	2.10	1.35
Raleigh, N. C.	1.50	1.75	1.50	[t].75	.85	1.75	[bg].85	1.50	1.75		[e]1.50	1.35	1.75	[bh]1.50		1.75	1.75	1.50	1.25	[e]1.50						
Richmond, Va.	1.65	2.25	2.00	.75	1.00	2.00	1.00	2.00	1.63	1.63	1.63	1.63	1.80	1.50	1.40	1.88	1.88	1.63	1.50	1.63	*	1.63	1.88	[e]1.88	1.63	.85
St. Louis, Mo.	2.20	2.25	2.25	1.35	1.35	2.25	1.75	2.25	1.75	1.95	2.15	2.25	2.25	1.80	2.04	2.25	2.25	[av]2.00	2.25	2.25	2.25	1.85	2.40	[av]2.40	[av]2.40	1.60
St. Paul, Minn.	1.80	2.08	2.00	1.30	1.30	2.08	1.40	2.05	1.90	1.90	1.83	2.05	2.06	1.75	1.70	2.00	2.00	1.73	1.73	1.90	*	1.85	1.85	[bi]1.85	2.00	[bi]1.43 [bj,b
St. Petersburg, Fla.	1.63	2.25	[e]2.00	.85	.85	2.25		2.25	2.25	2.25	2.00	1.50	2.00	1.50	1.50	2.00	2.00	1.25	1.50	1.63	1.50	1.75	1.75	1.50	[av]1.75	1.00
Salt Lake City, Utah	1.63	2.00	1.75	1.13	1.13	2.00	1.50	2.00	1.80	1.80	1.63	2.00	1.75	[bk]1.63	1.56	1.87	1.75	1.58	1.63	1.63	*	1.63	1.75	1.75	1.90	
San Antonio, Tex.	1.63	2.13	2.00	.75	.75	2.13	1.00	2.25	1.75	1.75	1.85	1.63	2.00	1.50	1.50	2.13	2.13	1.38	*	2.00	*		1.75	1.50	1.50	.75
San Diego, Calif.	1.90	2.25	1.98	1.35	1.35	2.25	1.63	2.25	2.20	2.20	1.98	2.25	2.15	1.95		2.50	2.25	1.75		2.00	*	1.85	1.85	1.90	2.10	1.43 [bl]
San Francisco, Calif.	2.00	[aq]2.25	2.25	1.40	1.40	[aq]2.25	[aq]1.75	[aq]2.25	2.00	2.15	2.03	[aq]2.25	2.25	[av]2.00	1.88	2.25	2.25	2.00	2.00	2.00	*	2.00	2.00	2.10	2.50	1.40
Seattle, Wash.	1.94	2.24	2.14	1.54	1.45	2.24	1.79	2.24	1.99	1.99	1.94	2.14	2.14	1.94	1.89	2.35	2.35	1.94	1.94	2.09	1.95	1.95	1.95	1.90	2.20	1.70
Springfield, Ill.	1.88	2.00	2.00	1.25	1.25	2.00	1.50	2.25	2.00	[av]2.15	1.75	2.00	1.88	1.88	1.75	2.15	2.15	1.85	1.85	1.90	2.15	1.50	1.95	1.65	1.95	[bm]1.30
Syracuse, N. Y.	1.85	2.10	2.00	1.20	1.20	2.10	1.20	2.00	1.95	1.95	1.90	2.00	2.20	1.65	1.65	2.10	2.10	1.85	1.85	1.85		2.00	2.25	1.70	2.25	1.10
Tacoma, Wash.	1.94	2.50	2.14	1.55	1.45	2.50	1.80	2.25	2.02	1.99	2.05	2.15	2.01	1.94	1.80	2.34	2.34	1.94		2.09		1.95	1.95	1.70	[av]2.50	[av]1.50
Toledo, Ohio	2.00	2.25	2.25	1.43	1.43	2.25	1.55	2.25	2.00	2.00	2.22	2.25	2.25	[bn]1.88	1.65	2.19	2.19	1.98	2.25	1.98	*	*	*	2.00	2.25	[t]1.30
Topeka, Kan.	1.50	2.00	2.05	.98	.85	2.00	1.22	2.00	2.00	2.00	1.75	1.63	1.75	[t]1.50	1.50	1.88	1.88	1.50	2.00	1.75	*	1.50	1.75	1.45	1.75	[e]1.18
Trenton, N. J.	2.25	2.40	[bo]2.88	1.40		2.40	1.40	2.40	2.40	2.40	2.40	2.25	2.50	[av]1.90	1.90	2.25	2.25	2.00	2.25	2.25		[bp]2.75		[av]2.13	2.75	
Wilmington, Del.	1.88	2.25	2.40	1.05	1.30	2.05	1.30	2.25	1.88	2.05	1.88	2.00	2.10	1.75	1.93	[av]1.95	1.95	2.30	1.88	2.00	2.00	2.13	2.13	1.75	2.25	1.25

NOTE: Hourly rates are rounded to closest cent where fractional parts of cent are quoted. [a] Same as craft doing work. [b] House painters. Steel painters, $1.90. [c] Metal. Wood lathers, $1.63. [d] Composition. [e] Brush. Spray, $2.25. [f] Ironworkers union. Electrical union, $2.15. [g] Spray, $1.50. [h] Metal and plate glaziers, $1.13. [i] Less than 2 tons. [j] Some employees agreements call for $2.34; includes certain percentage vacation pay. [k] Slate and tile roofers, $2.35. [l] On steel construction. [m] Dump truck. [n] Hard Soft, $1.55. [o] Brush. Spray, $1.65. [p] Bulldozers, power-grading, $1.75. [q] Brush. [r] Average. [s] Over 50 hp. with or without power takeoff. [t] 6 to 8 cu. yds. [u] Brooklyn-Queens, $2.81. Manhattan-Bronx, $2.50. [v] Slate and tile. [w] Composition. Slate and tile, $1.25. [x] Cement. Membrane, $1.10. [y] Brush. Spray, $2.03. [z] Composition. Slate and tile, $2.30. [aa] Slate and tile. Composition and dampproofing, $2.25. [ab] Power takeoff. Caterpillars, $1.85. [ac] 2-drum or more. 1-drum, $1.85. [ad] Non-union. [ae] Over 5 cu. yds. 5 cu. yds. and under, $1.30. [af] 120-B type and over. [ag] Dump truck, 5 yds. [ah] On steel, $2.25. [ai] Engineers on building hoists. [aj] Bull-dozer. [ak] Brushes Steel, $1.75. Spray, $2.00. [al] Over 40 hp. [am] 7-hr. day. [an] 8-hours pay for 7-hours work. [ao] 6-hr. day. [ap] 10-hr. day. [aq] 8–10 hr. day. [ar] 9-hr. day. [as] Caterpillar type. [at] Comparable March 1 rate is $1.88. [au] Comparable March 1 rate is $1.00. [av] Comparable March 1 rate is $1.50. [aw] Plus 15¢ for equipment. [ax] Chauffeurs and teamsters union. [ay] Lateral tile layers in plumbers-steamfitters union. [az] With dozier blades, $1.38. [ba] Comparable March 1 rate is $1.75. [bb] Comparable March 1 rates are common labor, heavy construction, 85¢; masons helpers, 85¢; truck drivers, over 1½ tons, $1.00 to $1.50.

WAGE RATE RANGES. [a] $1.25 to $1.50. [b] 75¢ to $1.00. [c] $1.75 to $1.88. [d] $1.40 to $2.00. [e] $1.73 to $2.00. [f] 90¢ to $1.00. [g] $1.75 to $2.00. [h] $1.75 to $2.15. [i] 95¢ to $1.10. [j] 85¢ to $1.00 (non-union). [k] 95¢ to $1.00 (non-union). [l] $1.00 to $1.15 (non-union). [m] 70¢ to 75¢. [n] $1.63 to $1.88. [o] 85¢ to $1.15. [p] $1.50 to $1.75. [q] $1.25 to $1.40. [r] $1.00 to $1.25. [s] 85¢ to $1.10. [t] 65¢ to 75¢. [u] $1.63 to $1.73. [v] $1.13 to $1.25. [w] $1.55 to $1.75. [x] 70¢ to 80¢. [y] 85¢ to $1.00. [z] $1.00 to $1.05 [aa] $1.25 to $1.60. [ab] $1.25 to $1.35. [ac] $1.50 to $1.63. [ad] $2.40 to $2.50. [ae] $1.08 to $1.18. [af] $2.50 to $2.88. [ag] 75¢ to 85¢. [ah] $1.35 to $1.50. [ai] $1.25 to $1.75.

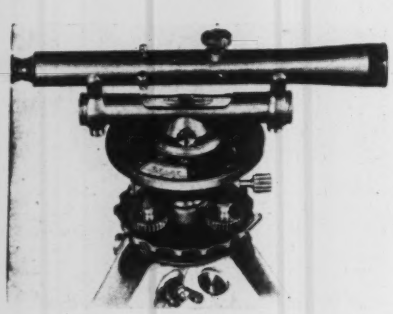
New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

ANTI-RUST PAINT—Rustrem (Rust Remedy) anti-rust paint is now available in aluminum as well as in black. This new paint can be applied right over rust without brushing or scraping. It is reputed to immediately penetrate the rust layer, render it inactive and seal the surface against further rusting. It has high resistance to chemical action and immunity to climatic changes and is recommended for use under water, in salt water, or in locations where dampness and moisture are ever present. Rustrem Aluminum can be painted over with any high quality paint or enamel.—*Speco, Inc., 3142 Superior Ave. Cleveland, Ohio.*

2

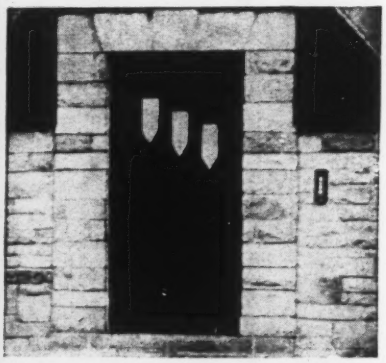


LEVEL—Brunson builder's level (dumpy type) is built for hard use. It will withstand abuse and is built to rigid specifications. Everything is enclosed against dust, dirt and moisture. The internal focus prevents looseness and wear—keeps dirt out. The level can be set on wall as well as on tripod. Removable trivet points allow it to be used on any surface. A most important feature is the fact that it is mounted on ball bearings, which are permanently lubricated and are completely sealed against dust. The clamps and screws are also enclosed in the body casting. It has an unusually large circle for easy reading. The optics are specially designed to give unusual brilliancy, so that observations can be made in unlighted buildings.—*Brunson Instrument Co., 1405-7 Walnut, Kansas City, Mo.*

3

GLASS BUILDING MATERIAL—A light weight building material, Dantore, formed of little glass globules, is "popped" by intense heat from raw perlite ore, and is suited, as one of its uses, to replace the sand in plaster. Dantore weighs only 12 lb. per cu. ft. as compared with sand's weight of 85 lb. Besides reduction in weight, plaster containing Dantore resists the checking and cracking of plaster caused by even slight settlement. The small glass globules and the gypsum are more flexible in adjustment to the stresses of settling. It also offers a considerable degree of insulation against heat, cold and noise.—*Dant & Russell, Portland, Ore.*

4



PACKAGED STONE ENTRANCE—Typical stone entrance package consists of some 35 units of stone, each piece precisely cut and numbered at quarry, for laying by home builder into specific entrance pattern. Stone units are compactly crated and shipped to homesite, along with blueprint showing correct position for each of numbered, cut stones. Any competent bricklayer can do job. Special skills of stone mason are not required. Builder can choose from twelve distinctive entrance patterns and order stone cut to fit any of four standard door openings.—*Conco Building Products, Inc., Mendota, Ill.*

5

CONCRETE PRIMER—Designed specifically for use on concrete structures, Southport No. 601 primer is said to effectively prevent absorption of external water from any source while allowing internal water to escape as vapor. It is suitable for brush or spray application, is highly pigmented, slightly off-white or near gray in color, and may be thinned. Companion material is No. 602 finisher, white in color and of brush and spray consistency, designed to protect primer from weather.—*Southport Paint Co., Inc., Savannah, Ga.*

6

CARRIER TELEPHONE—The light and power circuits of a construction job can double to carry voice communication with addition of simple Femco equipment. It can be used with amplifiers set sufficiently loud to be heard over noise of any construction equipment and to reach locations however remote, if they have electric connections on the job circuits. As many stations can be used as are desired with

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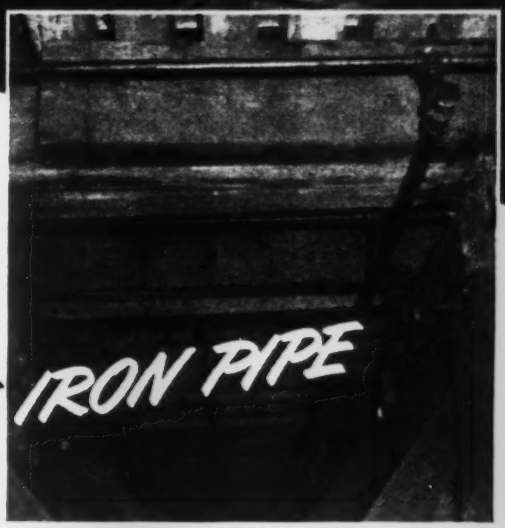
Nov. 13, 1947



DEPENDABLE

FIRE PROTECTION

CALLS FOR

CORROSION PROTECTION,

TOO

BYERS WROUGHT IRON PIPE

FOR SPRINKLER LINES

When this new merchandise pier, replacing an old pier that was destroyed by fire, was built by the Chesapeake and Ohio Railway at Newport News, Va., the engineers took definite steps to forestall future fire hazards. Sprinkler lines, on 8-foot centers and extending completely across the pier, were installed throughout its 800-foot length. To forestall the corrosion hazard, and assure that the system would be ready if needed, wrought iron pipe was selected for the lines. Byers Wrought Iron pipe was used.

If the engineers had needed any evidence to support this choice, the records would have provided it. In one installation, a railroad used Byers Wrought Iron in fire lines underneath two piers. After 32 years of exposure to salt water and salt spray, the lines were relocated. Examination revealed that the old wrought iron pipe was in such good condition that it was reinstalled, thus saving the cost of new pipe.

The reason for performance like this is found in the unique structure and composition of wrought iron. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting and rapid penetration. Further, the fibers help to anchor any scale, which shields the underlying metal.

If you are concerned with the design or installation of sprinkler systems, you will find some helpful information in our bulletin, "Wrought Iron in Salt Water Services." Ask for complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

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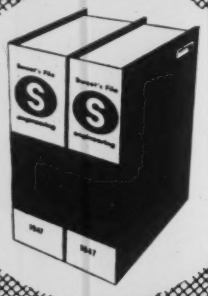
GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



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interconnections between such units as mixer plants, placing areas, steel yards, any electric equipment and the office. Underground the unit works on trolleys with constant direct contact to hauling locomotives or other machines. Equipment is sturdy, simple and compact. It consists of a trans-receiver unit, which is both transmitter and receiver, a resistor for lowering the line voltage enough to operate tube heaters, a speaker and a microphone.—*Farmers Engineering and Manufacturing Co., 549 Brushton Ave., Pittsburgh 21, Pa.*

7

SAFETY STICKERS—To remind a workman like a conscience—just when he is about to start a job in a way that is not safe—self-sticking safety stickers, known as SAFE-T-STIKRS, are 2 in. x 4 in. in size, colored and worded like a miniature billboard to demand attention and insure reading. Self-sticking, they are easy to press in place, easy to peel off clean and replace with fresh reminders to keep their "new sign" effect.—*The Howard Co.*, 15811 *Denker Ave., Gardena, Calif.*

8

ARC WELDED CONCRETE MIXERS—New 8-cu. yd. concrete mixer is 86 in. dia. It is constructed of four plates of ¼-in. carbon steel, sheared and formed in plant and welded in special fixture. For added strength, entire discharge end is double-butt-welded (illustrated). Water is provided by 200-gal. tank of ⅛-in. steel plates.—*Jaeger Machine Co., Columbus, Ohio General Electric Photo.*

9

TACHOMETER ADAPTER—For use with Metron hand tachometers high and low speed adapters are now available to increase or decrease the speed measuring range of these tachometers by a factor of 10 to 1. The adapters consist of precision built gear type speed changers which slip readily over the standard tachometer head. Type 46A adapter for low speeds (down to 10 rpm), gears the speed being measured up ten to one; Type 46B adapter for

Worthington-Ransome Blue Brute Distributors

See ad on page 165 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Gainesville, Constr. Equip. & Supply Co., Inc.
Miami, Allied Equip. Inc.
Orlando, Highway Equipment and Supply Co.
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Croushorn Equip. & Supply Co
Louisville, Williams Tractor Co.

Maine, Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co.
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazelton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Albuquerque, Bud Fisher Co.
Roswell, Smith Machy. Co.
N. Y., Albany, Milton Hale Machinery Co.
N. Y., Buffalo, Morroy Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith Commercial Body Works, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglass Equip. Co.
Oregon, Portland, Andrews Machinery

Pa., Wilkes-Barre, Ensminger & Co.
Mechanisburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, Patten Machy. Co.
Tyler, D. M. McClure Equip. Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
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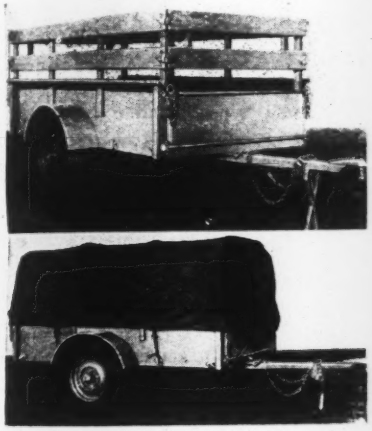
ciency. Shields can be removed to clean housing or for removal of impeller. Fan is attached to standard pinion shaft. Housing for 8-in. reducer, with 13.1 hp. rating at 1,750 rpm. (70:1) is 29 in. high, 16⅝ in. wide and 21⅝ in. across.—*Cone-Drive Division, Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.*

12

ENGINE-DRIVEN WELDER—Flex-arc lightweight engine-driven welder, designed for 200 amp. at 30 v. on basis of 50-percent duty cycle, comes with complete accessories. Generator is direct-connected to Hercules IXB engine. Welding current is adjustable from 30 amp. at 20 v. to 250 amp. at 30 v. It is available as portable or stationary model.—*Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.*

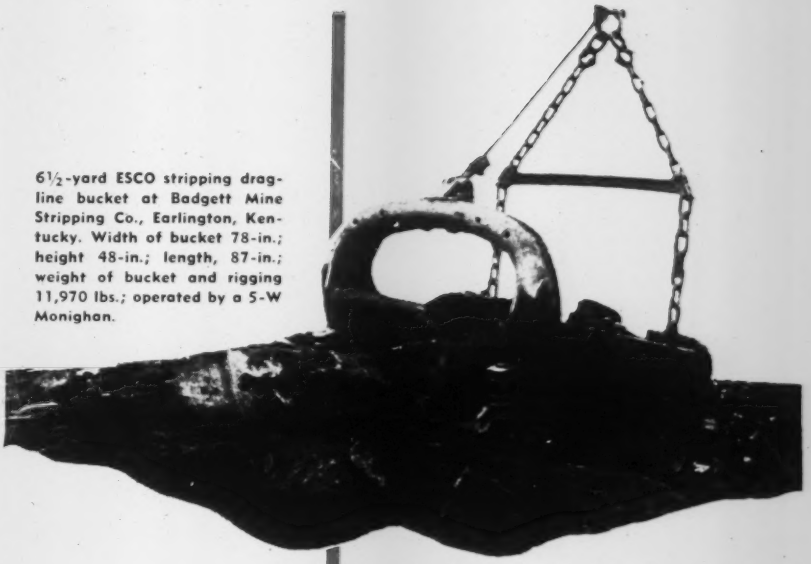
13



TWO-WHEEL TRAILER—Cobey two-wheel trailer is made in two sizes—6 and 8 ft. long. Both sizes are 4 ft. wide and have 17½-in. flared steel sides. Three body extension units are available for 8-ft. size. These include 22-in. low stake rack, 46-in. high stock rack (upper photo) and bow top with tarpaulin cover (lower photo). End gates are provided on both front and rear which swing from top as well as bottom. Floor is made of 14-gage ribbed steel, reinforced underneath with heavy cross-bolsters.—*Perfection Steel Body Co., Galion, Ohio.*

14

STORM WINDOW—SCREEN—A new all-aluminum combination storm-panel-and-screen unit, designed to save time and work for the home owner, has a self-storing feature that allows the screen and the two storm panels to stay right in the frame all year. The unit never needs painting or refitting;



6½-yard ESCO stripping dragline bucket at Badgett Mine Stripping Co., Earlington, Kentucky. Width of bucket 78-in.; height 48-in.; length, 87-in.; weight of bucket and rigging 11,970 lbs.; operated by a 5-W Monighan.

Efficient Digging multiplied by 7

The dragline bucket shown above is one of seven *ESCO* dragline buckets bought on repeat orders and working on this job. Such repeat orders are evidence of what most contractors know—

ESCO buckets deliver bigger payloads, have the strength to take the punishment of the toughest jobs.

No Excess Weight

ESCO engineers, all practical construction men, place weight where strength is required, eliminate bulk where it is not needed. Often larger size *ESCO* buckets can be used than would be possible with other makes.

Clean Cutting Front

Streamlined tooth horns are integrally cast into cutting lip—no bulky tooth holders. Flaring end teeth are placed close to edges to give maximum efficiency.

Resist Shock and Abrasion

ESCO Manganese Steel is used for all parts of bucket and rigging subject to wear and shock. This steel polishes in use, lessens friction, gets harder as it works. Parts need not be cast excessively heavy to allow for wear.

Three Types Available

Medium, standard and heavy duty.

Buckets for Special Jobs

Consultation invited on special buckets for unusual purposes. See your nearest *ESCO* representative, or write us direct.

Illustrated catalogs of all three types of dragline buckets will be sent you on request. Your ESCO representative will gladly give you one, or use coupon below.

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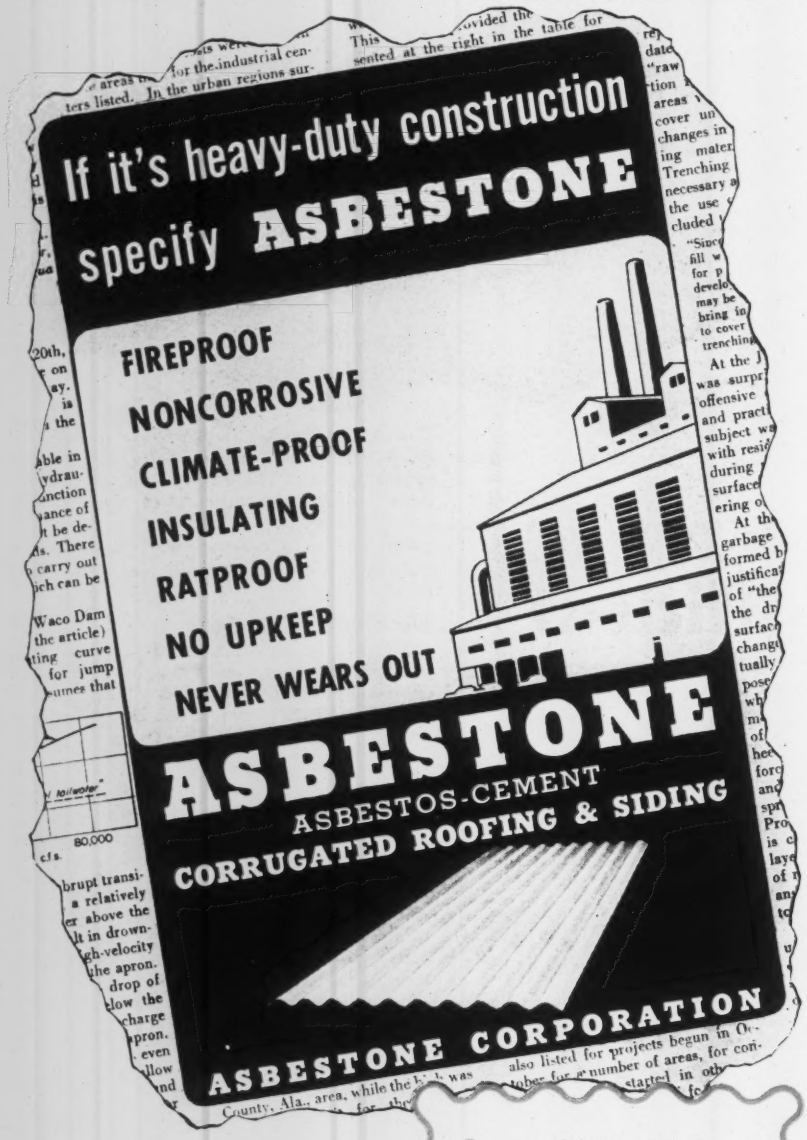

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it ends frosted and steamed windows. Closure sections provide a weathertight fit for any double-hung window. —*Ceco Steel Products Corp.*, 5701 W. 66th St., *Chicago* 50, *Ill.*

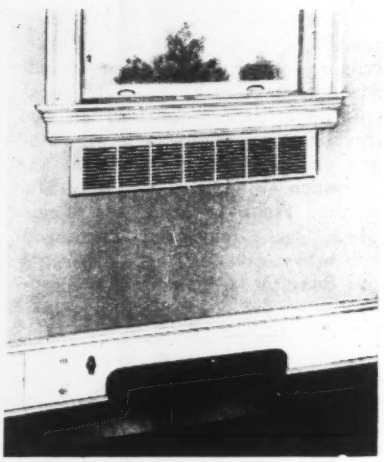
15

RUBBER BEVEL AND GROOVE STRIPS—A new method of forming bevels and decorative grooves on concrete surfaces by means of rubber strips attached to the forms instead of conventional wood strips is said to produce a smooth finish free of blemishes. The rubber can be re-used many times, resulting in lower construction costs. The strips will be produced in various shapes and sizes for bevels and decorative treatment. They are attached to the form with a waterproof adhesive and can be removed easily without chipping the mortar—*United States Rubber Co., Rockefeller Center, New York 20, N. Y.*

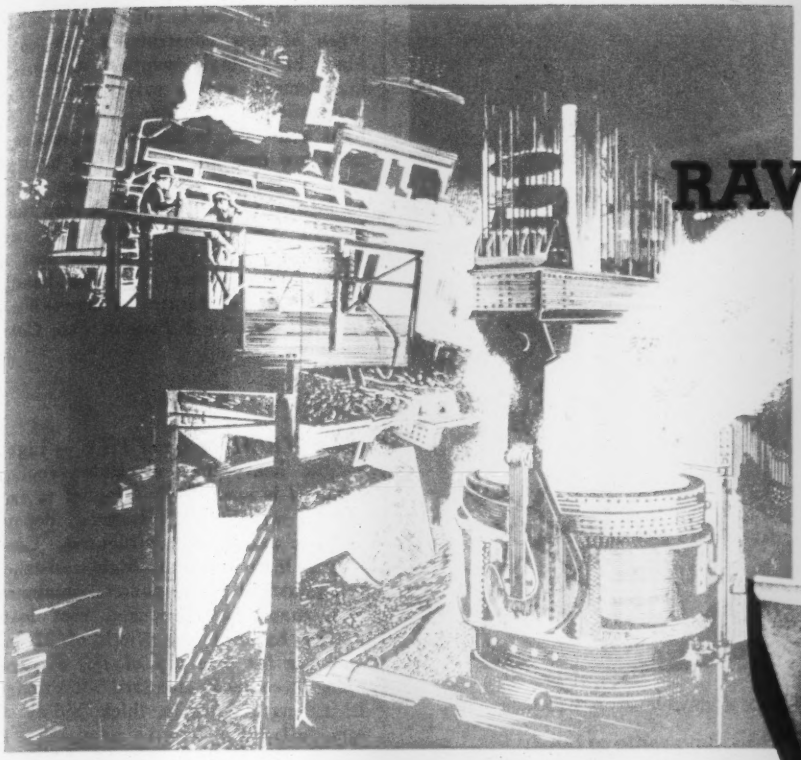
16

CONCRETE ROOF AND FLOOR UNIT—Permacrete Corflor is a new precast, prestressed steel reinforced, hollow-beam type concrete roof and floor unit for simplified residential and industrial construction. Steel reinforcing is prestressed on the tension side with the size of bars depending on the design load and span. Units are $7\frac{3}{4}$ x $7\frac{3}{4}$ in. with a 6-in. hole full length of the unit which may be 30 to 40 ft. When grouted in place they lay up in modules of 8 in. The air space in the hollow section is a good insulator and affords access for piping and wiring. —*Permacrete Products Corp., 1839 S. Wall St., Columbus, Ohio.*

17



PREFABRICATED RADIATOR—Recessed under windows and concealed in plaster walls, the new Webster



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Every ounce of steel that goes into Timken Rock Bits comes from Timken furnaces and is constantly under the control of Timken metallurgists. Developed as a direct result of our long specialized experience in steel manufacture and treatment it is the finest material ever produced for removable rock bits and is basically responsible for the outstanding performance, endurance and economy of Timken Bits in all kinds of rock.

Only in Timken Bits can you have the advantage of Timken steel plus Timken scientific design and precision manufacturing practice. We'll be glad to run tests under your operating conditions at any time.

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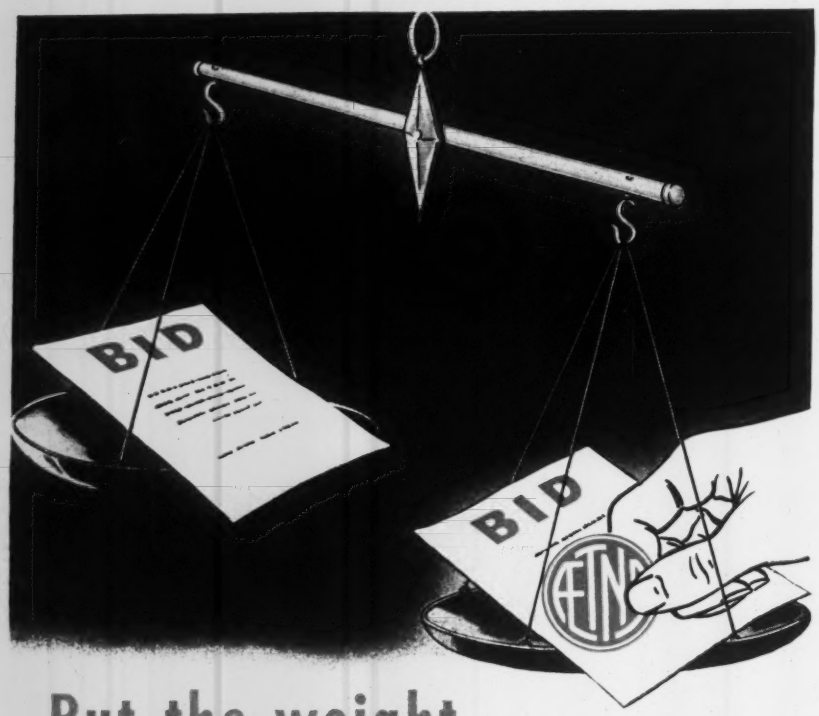
ROCK BITS



Put the weight of this name on your side

Someday, you may be bidding on a job in a place where your reputation has not yet been firmly established. The awarding body may narrow its choice to you and several other bidders, any one of whom could be given the contract on a basis of alternates. Under these conditions, if your Surety is nationally-known and highly regarded, this may be *just enough* to tip the balance in your favor.

A Surety which meets these requirements is the Ætna Casualty and Surety Company. Well and favorably known from coast to coast, the name of Ætna has been a symbol of strength, integrity, and service in the contract bond field for many years.

Establish your credit *now* with Ætna—a Surety whose prestige and financial stability will provide added proof of your responsibility on public or private jobs anywhere in the nation.

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Agents from Coast to Coast

ÆTNA CASUALTY AND SURETY COMPANY

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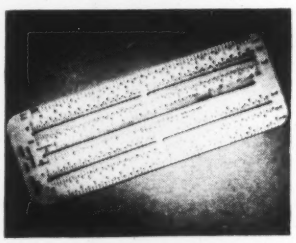
HARTFORD 15, CONNECTICUT

System Radiation is suitable for many types of new construction. It combines in a single compact unit heating element, supply valve, return trap and union connections. The unit is light and easy to handle and connections are easy to make. The heating element is contained in a sheet metal enclosure with openings at top and bottom for natural convected air movement; positive control of heat is made by extending the valve handle through the enclosure.—*Warren Webster & Co., 17th & Federal Sts., Camden, N. J.*

18

INDUSTRIAL ROOFING—Lightweight, heavy duty aluminum roofing material is specifically adapted to factories, warehouses, storage depots, hangars and similar structures. Combining high strength, high resistance to industrial atmospheres, minimum maintenance and reduced roof load, roofing has covering width of 32 in., allowing for side lap of 1½ corrugations. It comes in standard 5-ft. through 12-ft. lengths, .032 in. thick. Siding, of same alloy and lengths as roofing, is also in production.—*Aluminum Co. of America, 801 Guild Bldg., Pittsburgh 19, Pa.*

19

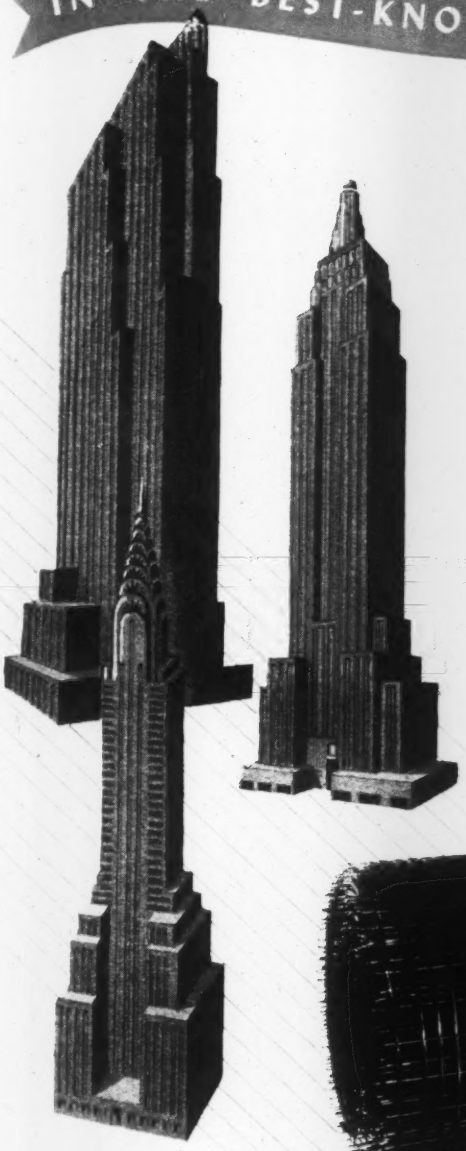


STAIR SCALE—A multiple device combines 10 scales for accurately spacing stair risers and treads, rafters, studs, joists, etc. without lifting or sliding the instrument from the drawing. It also provides an accurate architect's scale and quick, precise calculator for computing all factors in stair planning. All scales are calibrated ⅛, ¼, and ½ in. to one foot.—*Rapidesign, Inc., 111-B South Orange Ave., Glendale, Calif.*

20

WEATHERPROOF ROOFING NAIL—Weatherproof roofing nails use a neoprene washer which forms a seal between the head of the nail and the aluminum or other metal sheeting and roofing. This prevents corrosion due to electrolysis and leakage. Neoprene, it is claimed, will not get soft and mushy and run out from under the

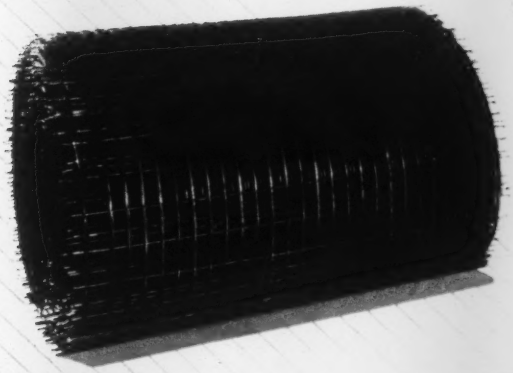
IN THE BEST-KNOWN BUILDINGS...

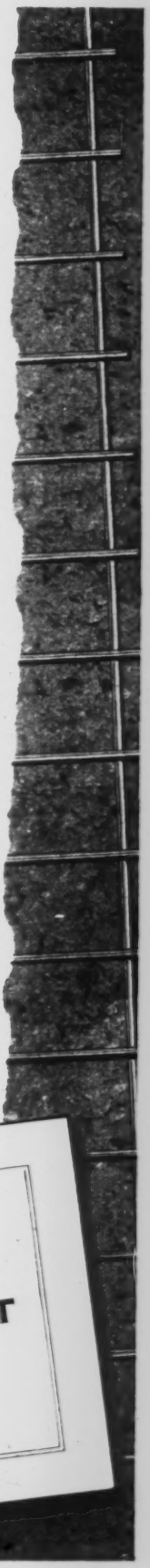


Welded Wire Fabric Reinforcement is preferred—in short-span concrete floor construction

ALL buildings in Rockefeller Center, New York, and many other prominent buildings —large or small—are constructed with Short-Span Concrete Floor Systems, reinforced with Welded Wire Fabric.

This prefabricated reinforcement material is delivered to the job in rolls. The ease and speed with which it can be placed, as compared to other types of reinforcement, are the chief reasons why Short-Span Floor Slabs are economical.





Build Longer Life Into Concrete

WELDED WIRE FABRIC

WIRE REINFORCEMENT INSTITUTE, INC.

NATIONAL PRESS BUILDING
WASHINGTON 4, D. C.

With Welded Wire Reinforcement

THE HELTZEL MILITARY HIGHWAY FORM

When you buy Heltzel Steel Forms, you have the advantage of doing business with people who specialize in concrete construction equipment . . . people who understand your problems.

Heltzel's reputation on Steel Forms has been gained through our understanding and co-operation with contractors, form setters, specification engineers, and all of the persons to whom the economical forming of concrete projects is of vital importance.

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(Type of construction usually engaged in)

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CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with lip curb and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

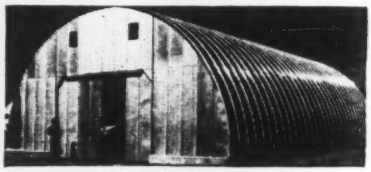
HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

nail-head when exposed to the heat encountered by metal roofs, nor will it harden and chip out as a result of winter cold. Machines developed by *Gora-Lee* fit together simultaneously newly-made nails and the washers. Two companies now supply the nails: *Nichols Wire & Steel Co., Davenport, Iowa,* and *Independent Nail & Packing Co., Bridgewater, Mass.*

21

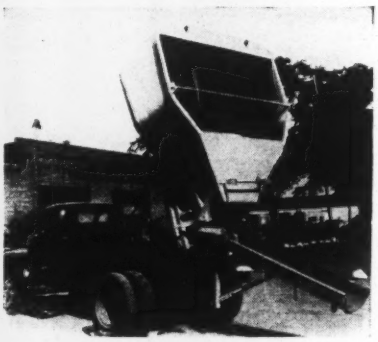
CORROSION-RESISTANT PIPE—Saran-lined steel pipe, designed to convey corrosive liquids, combines rigidity and pressure strength with Saran's extreme resistance to chemicals. The pipe is resistant to a very wide range of chemicals, oils and solvents and its working temperature ranges from 0 to 190 deg. F. depending upon service conditions.—*The Dow Chemical Co., Midland, Mich.*

22

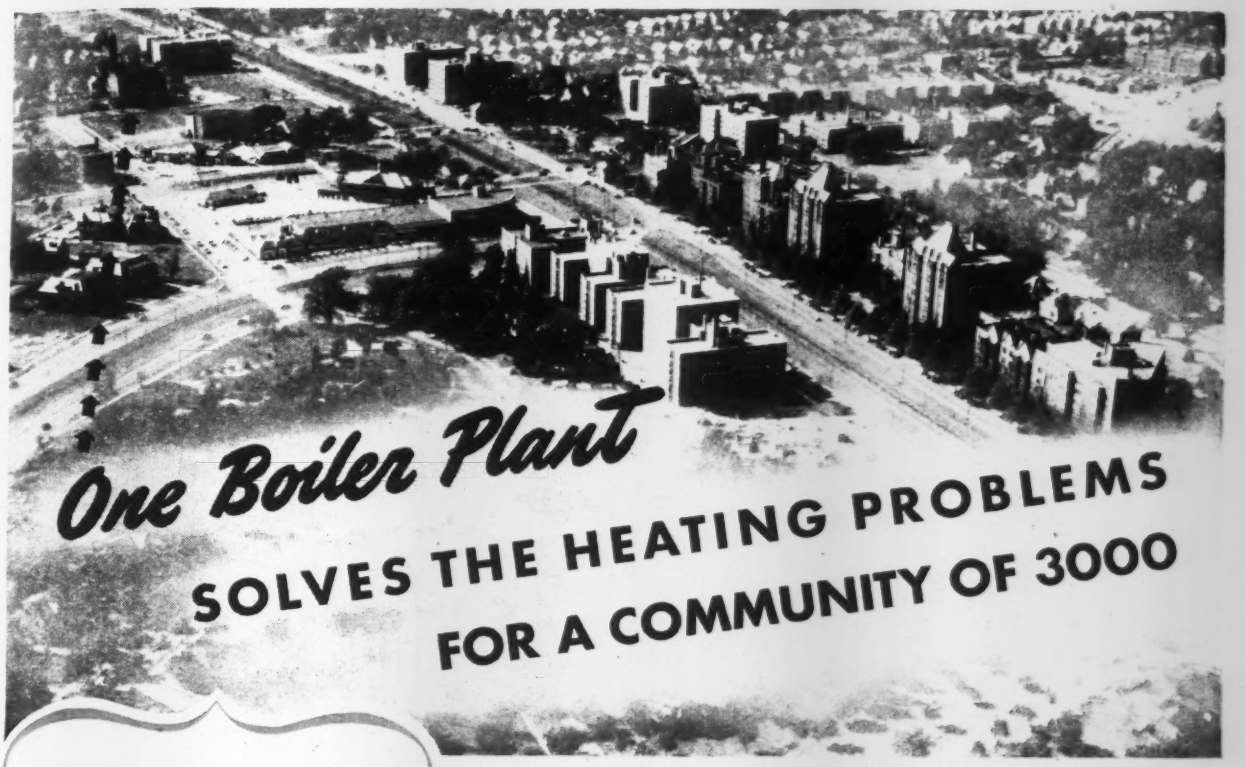


PREFABRICATED BUILDING—Alumi-Drome, standardized, arch-roof, all-aluminum, self-supporting building, is suitable for use as machine shop, storage shed, warehouse, garage and similar industrial uses. Standard size is 36 x 60 ft., but it employs standardized 6-ft. sections which allow length to be varied. Longitudinal members lock into arches to form strong rigid structural framework. After frame is erected, sheathing sheets are attached to ends and curved barrel sections.—*Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.*

23



ALL-PURPOSE DUMP BODY—Designed primarily for hauling and placing of top quality air-entrained concrete and adaptable to transportation of ag-

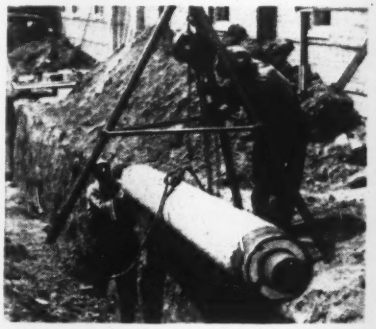


One Boiler Plant SOLVES THE HEATING PROBLEMS FOR A COMMUNITY OF 3000

BUILDINGS SERVED BY CENTRAL HEATING PLANT AT SHAKER SQUARE

- Apartments and multiple dwellings—housing approximately 700 families.
- Branch bank.
- Theatre seating 1,500.
- Tavern restaurant and Inn.
- Buildings containing 45 stores and 30 office suites.
- Large restaurant.
- Automobile Service Stations.

The Heating Plant is modern and fully automatic—requiring a crew of only 5 men. During the last complete heating season it consumed 8,000 tons of coal and produced approximately 140,000,000 pounds of steam.



Section of Ric-wiL prefabricated insulated steam conduit being lowered into shallow trench for steam connection to a new apartment at Shaker Square.

Seventeen years ago the Shaker Square district was planned by the Van Sweringen interests along lines now being considered by many communities for future development. A heating plant large enough to serve the entire district was erected and Ric-wiL underground steam conduit was installed for future connections . . . Time has proved the wisdom and foresight of the original planners. Today, this one boiler plant supplies heat and hot water through more than 10,000 feet of Ric-wiL Conduit to 700 apartments and multiple family dwellings, 45 stores, 30 office suites, a large tavern, a restaurant, a bank, a large theatre and 2 service stations.

Any Community Can Enjoy These Advantages:

- Savings of 15% or better in overall fuel consumption.
- Elimination of furnace or boiler tending by consumer.
- Promotes cleanliness in buildings heated.
- Provides extra room in building basements.
- Decreases fire and explosion hazard.
- Reduces smoke and soot, provides cleaner, healthier, community.
- Eliminates private coal delivery and ash removal.
- Gives uniform, clean heat quickly, whenever needed.

For information about Ric-wiL Conduit for central heat distribution get in touch with your nearest Ric-wiL agent or write to us direct.

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INSULATED PIPE CONDUIT SYSTEMS

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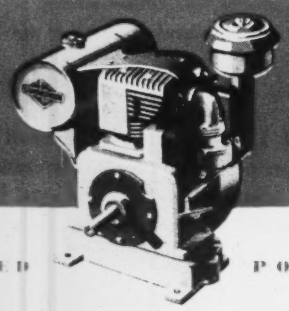
IN AIR-COOLED GASOLINE ENGINES



AIR-COOLED POWER . . .

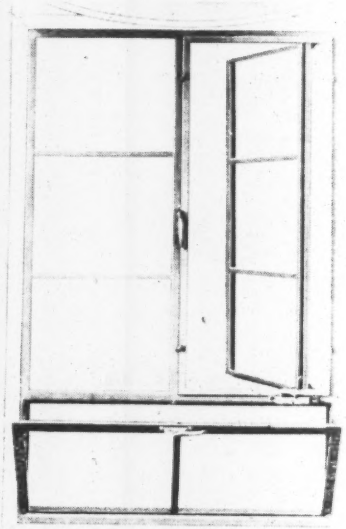
The trade-mark on a Briggs & Stratton engine is recognized as a *seal of proved performance.* Every step in the manufacture of Briggs & Stratton engines is based on the experience and technical knowledge gained during the 28 years of *continuous production.* Advanced engineering and refinements keep Briggs & Stratton out in front . . . years ahead . . . in every phase of engine building — as evidenced by the record established by more than 3 MILLION of them in operation in all parts of the world.

Preferred Power FOR INDUSTRIAL CONSTRUCTION RAILROAD AND FARM EQUIPMENT

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wisconsin, U. S. A.

gregate and similar bulk materials, new unit provides smooth, complete discharge of concrete from bottom of body first, preventing premature decantation of lighter materials from top of load and eliminating segregation and bleeding. Four point suspension and low hinging provide maximum safety in high discharge operation. Unit is easily maneuvered even on subgrades. Full-scale production of 3-cu. yd. capacity model is now under way.—*Hercules Steel Products Corp., Galion, Ohio.*

24



STEEL WINDOW—An in-tilting vent at the sill that protects against drafts, rain or falls is the special feature of a Fenestra steel bedroom window. When opened, the in-tilting vent at the sill sends air currents upward toward the ceiling, and protects the room's interior by deflecting rain, snow or sleet to the outside. The glass may be washed on both sides from inside the room.—*Detroit Steel Products Co., 2250 East Grand Blvd., Detroit 11, Mich.*

25

SAFETY WALK-WAY TILE—AMCOLUM safety tile is a homogeneous, compact structure, composed of abrasive material and other inert fillers evenly distributed, bonded together with a heat resisting thermosetting phenolic resin. Aluminum oxide is the abrasive used, assuring long wear, in addition to a slip-proof walk-way surface. The tile is extremely resistant to shock impact, light in weight, averaging 2½ lb. per sq. ft., with a total installed weight including the special adhesive of 3½ lb. It may be

Contractors all over the country use C. I. T. funds to buy construction equipment. In this way they avoid tying up too much working capital and are left free to use their money for day-to-day operating expenses.

In buying machinery and equipment it is only necessary to make a moderate initial investment. C. I. T. will furnish the balance needed to complete the purchase and our loan can be repaid in monthly instalments over extended periods.

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"I needed additional equipment to handle the contract just awarded me, but it was difficult for me to pay all cash. Your financing plan solved my problem immediately."

"I need some new equipment costing $24,000, and I'd like to have C. I. T. finance it for me."

"Now I can afford to buy better equipment because your plan permits me to spread the cost over several months."

"The machinery I financed through C. I. T. has paid for itself out of increased earning capacity. Thanks for your assistance."

When you buy construction machinery and equipment, remember that C. I. T. is a dependable source from which you can obtain financial assistance. Just tell us what you want to buy, the balance to be financed and how you want to pay for it. We'll cooperate with you or your distributor to arrange all further details. Ask any of these offices for complete information.

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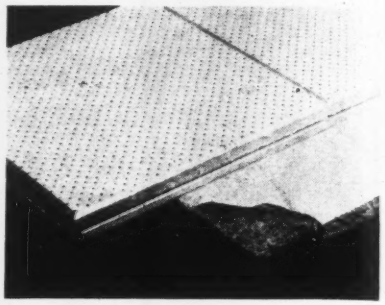
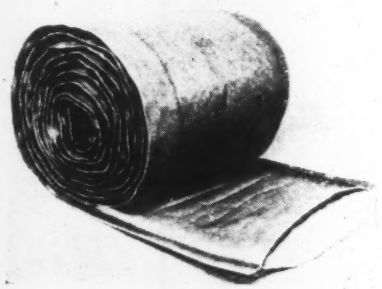
applied over existing wood, concrete or steel floors.—*American Abrasive Metals Co., Irvington, N. J.*

26



ACOUSTICAL UNIT—A metal pan acoustical unit for use in buildings requiring a permanently incombustible noise quieting and acoustical treatment is called Arrestone. It is a perforated metal pan containing a flameproof paper-wrapped mineral wool sound absorbing pad, held away from the perforated surface with a metal grid, allowing the entire surface of the pad to absorb noise. Pans are 12 x 24 x 1-¼ in. with a ⅝ in. bevel on all face edges, dividing the pan into two parts. Noise-reduction coefficient is .85.—*Building Materials Division, Armstrong Cork Co., Lancaster, Pa.*

27



FLAMEPROOF INSULATION—Cellulite flameproof cotton building insulation has a sturdy vapor seal on one side, and tough paper covering on the other side for convenience in handling. This Type E Cellulite is made in the same standard widths as regular Type II which has vapor seal only.—*The Gilman Brothers Co., Gilman, Conn.*

28

PHOTOGRAPHIC PAPER—A silver-sensitized paper for reproducing engineering drawings on blueprint or direct-process equipment is known as Kodagraph Autopositive. The paper embodies a new type emulsion which

prevent this loss with ANOTHER DOW PRODUCT

Now you can build for *permanence* with treated lumber that's *clean* lumber. Pentachlorophenol makes possible this greatest advance in wood preservation. It provides lasting, effective protection against both decay and termites—yet, properly applied, it leaves wood non-sticky, easy to handle, paintable!

Check almost any building—inside or out—and see how the ravages of weather, dampness, ground contact or termites make wood fail. This costly loss can be prevented by building with Pentachlorophenol treated lumber—a fact proved by extensive ten year tests.

Applied at low concentrations in petroleum oils by established pressure and non-pressure treating methods, Pentachlorophenol is available *now*.

the clean wood treatment

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See How You Can Cut Maintenance Costs!

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Industrial plants, warehouses, docks, transformers, oil quench tanks—no two are alike, hence no two should be treated alike in the matter of fire protection.

"Automatic's" job for many, many years has been to design, manufacture and install fire protection systems. We know that what is adequate in one instance may not be suitable in another. Fire protection in a cold storage plant, for example, would be wholly inadequate for a powder manufacturer.

Right there is where the knowledge and skill of "Automatic's" engineers is of inestimable value. Drawing from a wealth of experience, they recommend only that fire protection system which is *best-by-test for any given purpose or condition.*

Today's executives, entering upon an era of peace-time effort, know the wisdom of safeguarding lives and property . . . which explains why so many are writing "Automatic" for detailed information on fire protection. Why don't you?

—a famous member of the "Automatic" Sprinkler Family. Provides adequate protection for quench tank, transformer, oil line and other fires of flammable liquid origin.

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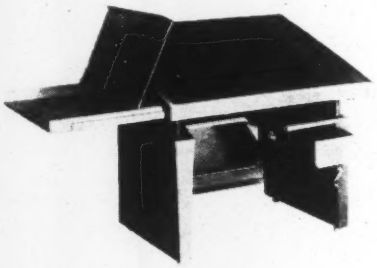
permits its use in normal room light and produces a high-contrast positive copy directly from a positive original. Such copies are intended primarily for use as printing intermediates or "masters" and make possible quick and economical production of blueprints or diazos of exceptionally high quality. This paper is also said to cut down redrafting and no darkroom is needed. It is supplied in standard sheet and roll sizes.—*Eastman Kodak Co., Rochester 4, N. Y.*

29



DRAFTING DESK—An all-steel adjustable drafting desk has many exclusive features. The Work Flow all steel desk is finished in metallic gray with desk top linoleum, available in several sizes, offering a large drawing surface up to 60 in. The tilt-top feature facilitates convenient working angles up to 20 deg. and height is adjustable from 29 to 38 in. The desk is designed scientifically for minimum fatigue, maximum comfort and convenience, with storage space for supplies, drawing paper and reference materials.—*Haskell Manufacturing Co., Dept. E.N.R., 206 Penn Ave., Pittsburgh, Pa.*

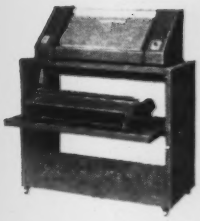
30

WIRE-CORD TRUCK TIRES—Truck tires using wire-cord which have fewer plies than tires of the same section size made with conventional cord fabric, are the outgrowth of a long development program. The thinner wire-cord tire runs cooler than conventional tires under equivalent conditions of service. The higher strength and cooler running tires are expected to give enough greater total mileage to more than offset what now appears to be higher initial cost of the tire.—*B. F. Goodrich Co., Akron, Ohio.*

31

CONVERSION SCALE—The Kohlberg conversion scale for making drawings that may be scaled in metric measurements, without the need of conversion calculations, is so constructed that the draftsman does not have to learn a new

ONE SIMPLE MACHINE . . . .



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The Model 2 Printer provides a convenient means of making Bruning BW Direct-Line Prints from any translucent or transparent original material. Prints are made directly from originals—no negative is needed. BW Prints are developed in the Model 153 Developer, combined in a simple stand with the Printer.

Then, at the flick of a switch, the Model 2—a continuous printer not to be confused with "copy-box" methods—exposes Copyflex Photographic Prints. You can have clear reproductions of shaded drawings, photographs, halftones, etc., and reproduce opaque originals either from one or both sides. Copyflex Prints are developed with three trays and a simple drier (readily available).

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... and best where wear is hardest

Triple-protection does it! Plasteel is made of high strength steel . . . triple-coated on both sides of the sheet. First with an exclusive formula, non-corrosive bond coat. Then an air-tight, weather-sealed plastics coat for extra protection. The third, a pure mineral mica finish coat for extra insulation. The silvery mica also adds attractive appearance that needs no paint, no repairs, no maintenance. *Built-in strength through and through.* That's why Plasteel is Roofing and Siding at their very best.

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6 ECONOMICAL

Plasteel is built for industry's toughest assignments. That's why architects, engineers and maintenance men specify Plasteel for modern industrial buildings.

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47-14

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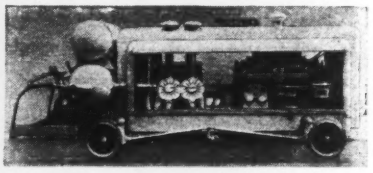
way of scaling off dimensions. He can continue to make his calculations in feet and inches, as the scale is so divided. The scale has: 1/10, 1/20, 1/50, 1/100, 1/250 and 1/500 ft. divisions. One edge is divided in millimeters. After a drawing has been made with the conversion scale, it can be scaled with metric scales by direct reading. Another use for the scale is the analysis of drawings made abroad in some metric scale.—*The Kohlberg Conversion Scale Co., 29 Bank St., New York 14, N. Y.*

32

ALUMINUM NAILS AND STAPLES—Nails are available in sizes 3d to 40d. Staples are available in 9-gage, 1 and 1¼-in. sizes. They can be used in same applications, in same types and sizes, as steel nails and staples. Aluminum roofing nails up to 9-gage are available with neoprene washers. Also available are shingle box, plaster board, asbestos shingle and siding nails.—*Nichols Wire & Steel Co., Davenport, Iowa.*

33



RAIL-CAR COMPRESSORS—Manufactured in 60, 105, 160, 210, and 315 cfm. capacities, new unit is equipped with railway type brakes and operator's platform capable of carrying four persons. Motive power is furnished by air motor with clutch, which provides forward and reverse speeds of from 4 to 10 mph. Because of its power reserve, machine can be used to tow other equipment. Transverse wheels provide for easy removal from tracks.—*Davey Compressor Co., Kent, Ohio.*

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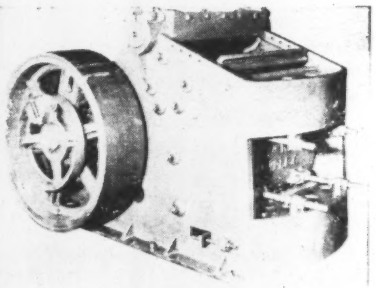
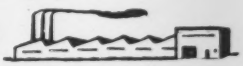
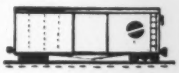


ROCK CRUSHER—Kue-Ken Simplex is lightweight, large capacity crusher with ability to produce ¾ or 1-in. sizes of hardest rock with low power re-

More Cities, Counties, States,

than ever now *remove* ice and snow with STERLING "*Auger Action*" Rock Salt

Icy pavements and snow-filled streets and highways slow or block traffic! Bring death and injury! They lower factory production, cut store profits, bring customers untold inconvenience... even cause fuel and food shortages.

Snow and ice can be quickly removed with STERLING "*Auger-Action*" Rock Salt! Time, labor and money are saved. People, traffic, business and industry keep going!  Do as others are doing. Use STERLING Rock Salt. *ORDER NOW! in* carloads,  bulk or 100-lb. bags. A trained representative will gladly call. *Write Today!*

International Salt Company, Inc. Scranton, Pa.

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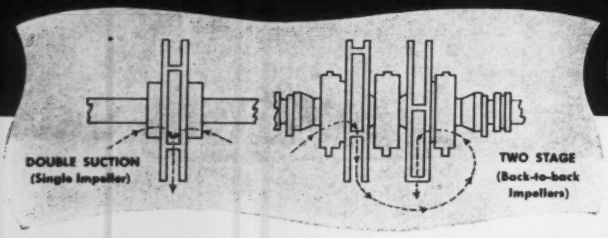
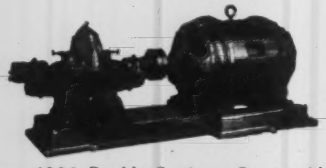
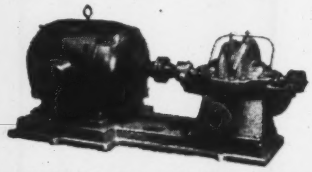
AMERICAN *Double Suction and Two-Stage Centrifugal Pumps Minimize End-Thrust Wear...Give Longer Trouble-Free Service*



• The principle of balanced power . . . the equalization of hydraulic forces . . . which has been engineered into these two outstanding clear liquid pumps prevents motor power from being frittered away in costly and useless end-thrust. Horse power is devoted to the specific task of pumping!



Type 4000 Double Suction — For a wide range of applications in general water supply and clear liquid transfer. Split case, ball bearing design. Enclosed type, bronze, double suction impeller . . . with all water passages hand finished and exterior surfaces machined. Capacities from 50 to 7000 GPM. Heads from 25 to 250 feet. *Bulletin No. 248.*



Type 4400 Two Stage Single Suction — For water and clear liquid booster service. Split case, ball bearing design. Passage from first to second stage entirely within casing, reducing friction losses to a minimum. Back-to-back, single suction, bronze, enclosed type impellers. Capacities from 50 to 1500 GPM. Heads from 50 to 450 feet. *Bulletin No. 246.*

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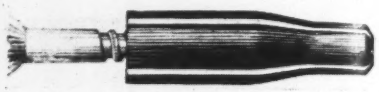
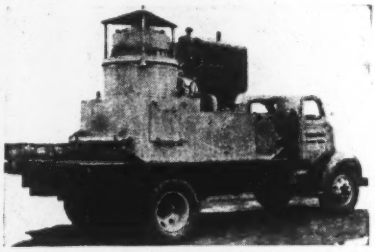
quirements. Requiring lubrication only once every 6 months, 16,500-lb. machine has 36 x 10 or 36 x 12-in. jaw opening. Speed is 350 to 365 rpm. and capacity is 40 to 50 tph. at ¾-in. setting and 50 to 60 tph. at 1-in. setting. A maximum of 40 hp. is required on hard rock.—*Straub Mfg. Co., Inc., 507 Chestnut St., Oakland, Calif.*

35



SCREW ANCHORS—Sandscott plastic expanding anchors are said to simplify anchoring, reduce costs and assure tremendous holding power. They may be used with wood screws or lag screws for fastening to any material. In pull-out tests, maximum load pull was 2,965 lb. using No. 20 screw. Anchors are available in seven sizes ranging from No. 5 to No. 20, or ¼-in. and 5/16-in. lag screws.—*Holub Industries, Inc., Sycamore, Ill.*

36



PORTABLE CRUSHING UNIT—New unit consists essentially of 22-in. Symons cone crusher, motor and drive, mounted on welded-steel supporting base and skid. Specially applicable to contractor type service, it is also efficient unit for semi or fully portable operations or for stationary plant operation as compact, self-contained, secondary reduction unit. Capacity varies from 20 tons per hour at 3/8-in. setting to 60 tph. at 1½-in. setting. Electric driven unit is furnished with 25-hp. 1,200-rpm. motor for 60-cycle service. Diesel engine has oversize rating of 50/55 hp. at 1,500-rpm. governed speed. Overall dimensions are 122½ in. long; 71½ in. wide, including V-belt drive and housing, and 86¼ in. high.—*Nordberg Mfg. Co., Milwaukee 7, Wis.*

37

TILTING MIXER—Improved 3½-S end-discharge tilting mixer is towed in mixing position, with support legs at rear. Thus, unit may be backed directly up to material piles and, with towpole removed, is ready to go to

THE A. B. C.
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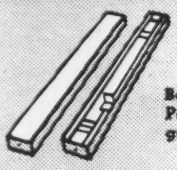
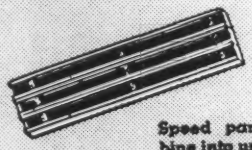
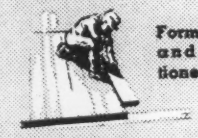


Basic unit, the Speed Panel, made of rugged steel.

Ingenious, quick-action, wedge bolt, for rapid joining or stripping.



Speed panels combine into units of two or more for quick handling.



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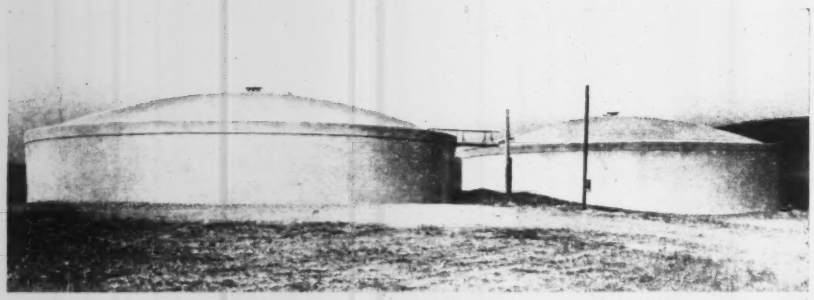

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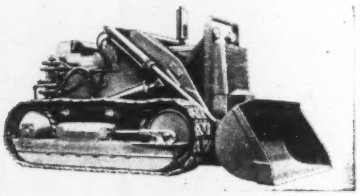
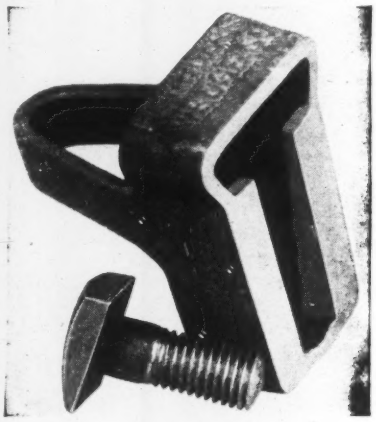
work without turning or spotting and without projecting feet in front. V-bottom drum design combines with two double mixing blades to produce fast, criss-cross movement of material. This adapts machine to efficient mixing of plaster or bituminous material, as well as concrete, without excessive accumulation of material in drum and with very fast discharge action. Drum turns in two Timken tapered-roller bearings. Unit is driven by 2½-hp. aircooled Wisconsin engine.—*Jaeger Machine Co., Columbus 16, Ohio.*

38



BULLDOZER-SHOVEL — Designed into International TD-14 diesel tractor, Model 14 2-yd. unit has large capacity, front mounted hydraulic pump, directly connected to engine crankshaft to supply power for all operations. Automatic bucket tip-back tilts bucket back 38 deg. in carrying position to prevent spillage. Tracks are not tied down, but oscillate freely to conform to ground contour. Front-end superstructures are entirely eliminated, permitting complete visibility. Bucket extends full width of tractor to permit excavation close to walls, embankments and slopes. —*Frank G. Hough Co., Libertyville, Ill.*

39



CONCRETE INSERTS—Peerless wedge is powerful insert designed to support in adjustable position shelf angles commonly used to carry veneer or exterior facing of building walls. US436 has ¾-in. wedge casting complete with 1½-in. long askew head bolt, nut and washer. US425 has ⅝-in. wedge casting. Special belt 1¾, 2, 2½

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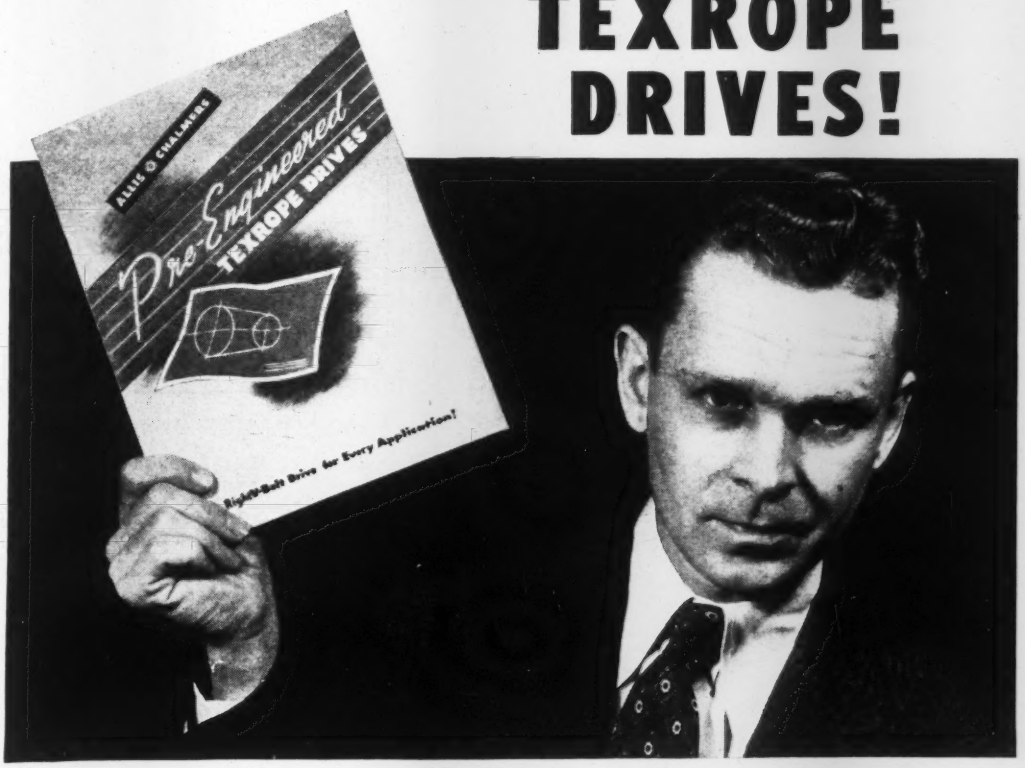

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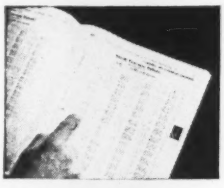

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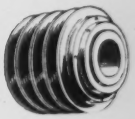

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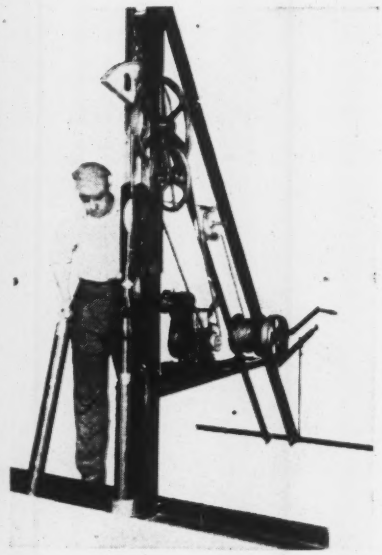

WELL DRILLER—New machine has 6x6-ft. base and is 8 ft. high and weighs 450 lb. Drill bit weighs over 125 lb. and will drill hole suitable for sinking 4-in. casings. It operates on ½ or ¾-hp. electric motor or small gasoline engine.—*Consolidated Industries, 9 S. Colony St., Wallingford, Conn.*

41

TWIN-CONTROLLED BULLDOZERS—Drott Twin-Controlled tilting bulldozers and bullangledozers are operated by Drott's closed hydraulic system. The name "Twin Control," is derived from the twin pump arrangement, mounted on the front of the tractor. Each pump operates a cylinder through separate valves and enables the operator to raise or lower either side of the blade from the seat. Other features include close mounting of blade to radiator for better balance, good operator vision and simple rugged construction through a "cradle lift." —*Drott Manufacturing Corp., Milwaukee 12, Wis.*

42

GLASS BLOCK INSTALLATION—Hydrocide 600 is recommended by company for preparation of surface before setting glass blocks. This emulsified asphalt prevents etching of block by lime present in adjacent masonry. Another product, Hydrocide powder, can be mixed with mortar in which

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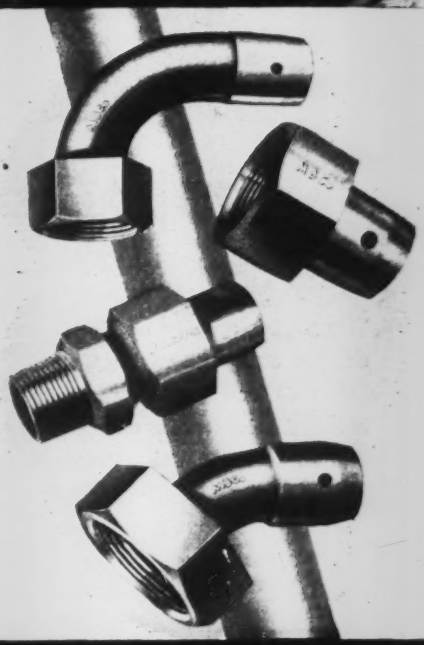

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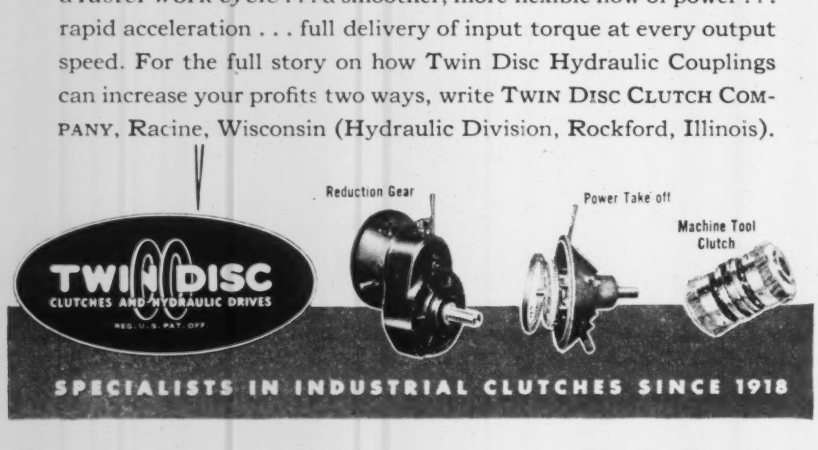
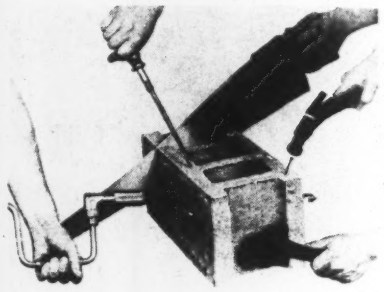


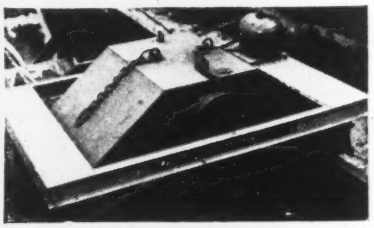
block is set to secure maximum resistance to water and tighter adhesion to block. This powder coats sand with water-insoluble calcium stearate, lines internal pores and capillaries of mortar and imparts increased resistance to water absorption as well as dimensional stability to finished mortar. Kaukit, elastic non-hardening caulking and glazing compound, is used for finishing surface of joints.—*L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*

43



BUILDING BLOCKS—Mul-Kra Wonder Blocks are based on patented formula containing wood fiber and special mastics, including cement, produced on conventional blockmaking equipment. They are identical in size and appearance with regular concrete blocks. They can be sawed, sanded, drilled, nailed and screwed and contain many of same working properties as wood. Tests show high compressive strength and thermal conductivity. They are lightweight and fire resistant. —*Marketing Associates, 904 Lapeer St., Saginaw, Mich.*

44



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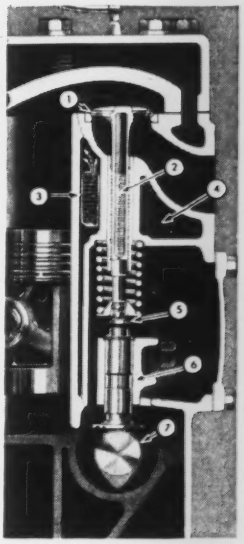
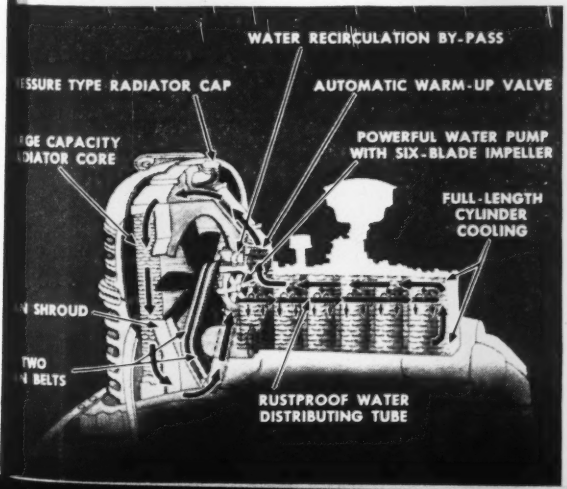
Everywhere, unnecessary surplus weight is eliminated by improved design and advanced metallurgy. New and strictly *heavy-duty* clutches, and a remarkably efficient five-speed transmission—coupled with rear axles of entirely new design—provide a highly efficient transmission of driving torque to the wheels. Despite their husky construction and rugged strength—these trucks handle with ease, even on steep grades with capacity loads.

If *your* transportation requirements fall within the 18,500 to 23,000-pound gross vehicle weight ranges (up to 40,000 pounds G.T.W.) . . . get the complete story of these great new Dodge *"Job-Rated"* heavy-duty trucks from your Dodge dealer. We believe you'll find them your long-awaited answer to *lower-cost hauling* in their capacity ranges!

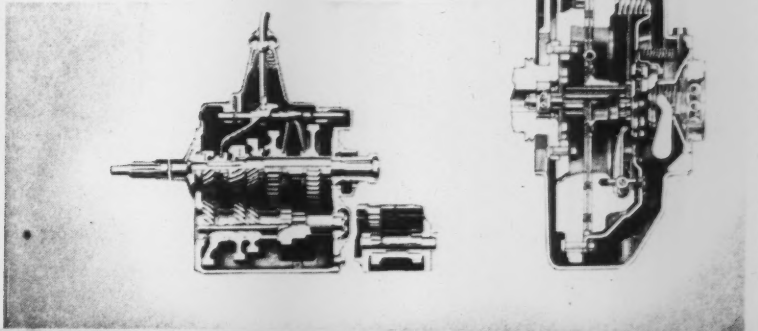


1. Stellite-faced exhaust valves and seat inserts. (All valves and valve seat inserts are of hard, durable silchrome.)
2. Sodium-cooled exhaust valves.
3. Rustproof water distributing tube for exhaust valve seat cooling.
4. Large water pockets surround valve stems for quick heat dissipation.
5. Self-locking adjusting screws facilitate tappet adjustments.
6. Tappets lubricated by pressure feed for long life.
7. High-test cast iron alloy camshaft supported by four large bearings.

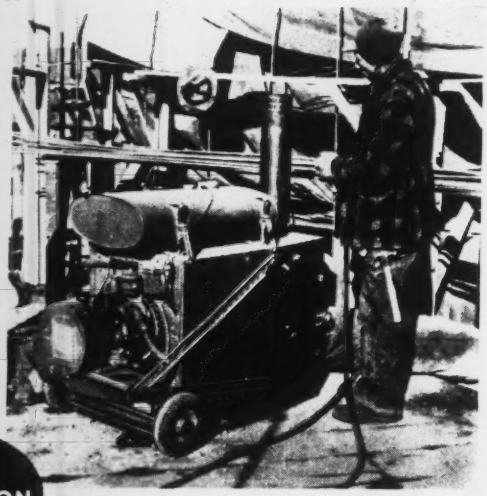


This highly effective cooling system is an important reason for the greater economy, dependability, and longer life of these heavy-duty trucks.

Rugged 5-speed transmissions and heavy-duty clutches, with capacity well in excess of engine torque, insure long life, low-cost maintenance.



DON'T GAMBLE WITH MANPOWER!



LENGTHEN THE WORKING SEASON WITH HERMAN NELSON PORTABLE HEATERS

ASSURE PRODUCTION BY:

SPACE HEATING of temporary buildings, storage sheds, repair shops, buildings under construction.

PREHEATING engines and all kinds of mechanical equipment.

SPOT HEATING of materials, workmen, machinery, storage tanks, tools.

THAWING frozen areas and machinery, wheels, gears, transmissions, caterpillars, etc.

DRYING and curing of materials, plaster, paint, mortar, concrete, etc.

VENTILATING and heating of manholes, tunnels, box cars, ship holds, confined areas of all kinds.

Your workmen are your greatest asset! Keep them going all winter with Herman Nelson Portable Heaters. These efficient units provide quick, clean, safe HEAT—where you want it—when you want it—without waste. Jobs go ahead faster, men are able to work better, schedules are more easily met—when Herman Nelson Portable Heaters are protecting against costly shutdowns due to cold. No bigger than a kitchen stove, this unit generates enough heat for three ordinary 5-room houses. And it's all done without smoke, soot or open flame!

Write for Interesting, Free Booklet on "Cost Control"

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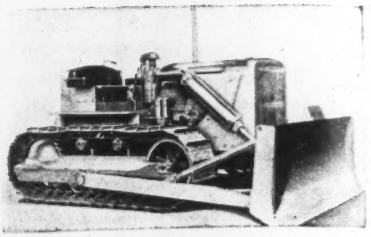
Hayward Buckets

Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.

THE HAYWARD CO., 48-50 Church St., N. Y. 7

ute.—*Robins Conveyors, Inc., Passaic, N. J.*

45



HYDRAULIC CONTROLLED BULLDOZERS—Designed exclusively for use with Caterpillar diesel D8, D7, D6 and D4 track-type tractors, four new hydraulic controlled bulldozers are matched in quality and capacity to power of tractors for which they are designated. They are offered in addition to the cable controlled bulldozers for D8, D7 and D6 models.—*Caterpillar Tractor Co., Peoria 8, Ill.*

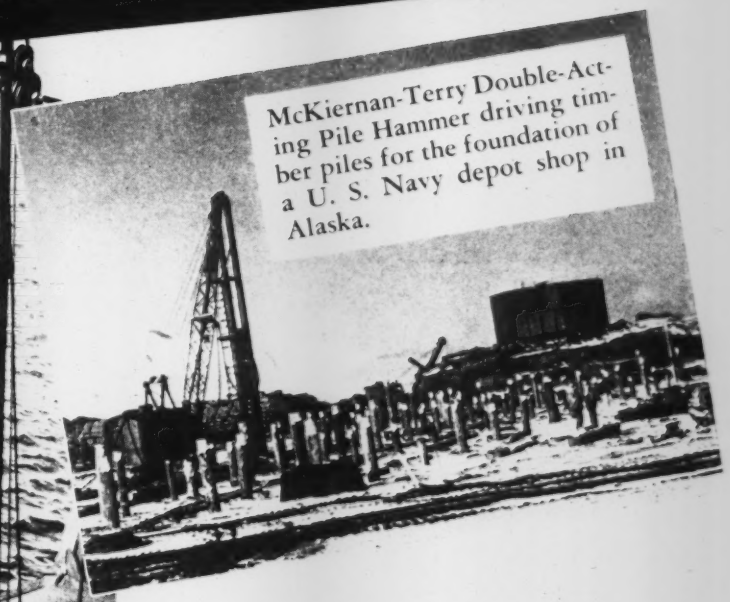
46

SMALL POWER ROLLER—Cutting down a road roller from elephant-size to pony-size, and still keeping it rugged, is accomplished in a new roller, believed to be the first ever built for rolling driveways, and the like. It is almost entirely of all-welded steel construction, it weighs one ton, has a 3.5-ft. wheelbase and 42-in. body width. Weight can be increased when desired by adding a 600-lb. concrete block in the machine bed. Each roller section, of watertight welded construction, can be filled through an inlet in the side wall.—*Steel Equipment Co., 2890 East 83rd St., Cleveland, Ohio.*

47

FLEXIBLE SHAFT MACHINE—Known as the WYCO "Streamflex," a new flexible shaft machine is designed to combine increased convenience and complete safety in a streamlined, cabinet-enclosed, multi-speed machine of all welded steel construction. All pulleys and belts are fully enclosed. The entire cabinet swivels on ball-bearing motor base, with handy 16-in. tool tray, and machine is designed with low center of gravity, eliminating all danger of tipping.—*Wyzenbeek & Staff, Inc., West Hubbard St., Chicago 22, Ill.*

THE NAVY KNOWS HAMMERS



McKiernan-Terry Double-Acting Pile Hammer driving timber piles for the foundation of a U. S. Navy depot shop in Alaska.

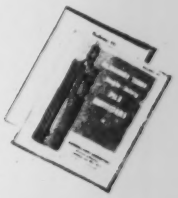
McKiernan-Terry Double-Acting Hammer driving timber piles to strengthen a pier at the U. S. Navy Submarine Base, New London, Conn.

On pre-war, wartime and post-war construction projects of the U. S. Navy, McKiernan-Terry Pile Hammers have been a frequent choice. During the war they were used in practically every theatre of operations. For Navy engineers, like contractors on civilian construction, make their choice of equipment on a basis of performance. In selecting McKiernan-Terry Hammers they expect and get powerful, dependable, safe operation.

There is a right McKiernan-Terry Pile Hammer for any specific type of job. Double-Acting Hammers in ten standard sizes; Single-Acting Hammers in five; Double-Acting Extractors in two.

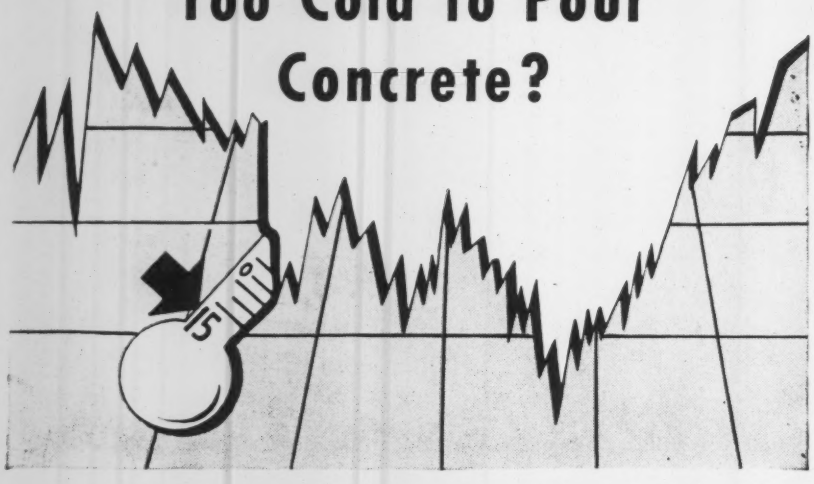
FREE ***DESCRIPTIVE BULLETINS***

Write for Bulletins No. 55 and No. 57 giving full information on McKiernan-Terry Double-Acting and Single-Acting Pile Hammers.



McKiernan-Terry
CORPORATION
Manufacturing Engineers
13 PARK ROW, NEW YORK 7, N. Y.

Too Cold to Pour Concrete?



not with TRIMIX

the admixture that keeps winter concrete work on schedule

TRIMIX facilitates the mixing, pouring or laying of concrete at temperatures as low as 15° F. below zero. In addition to dispersing the cement and lowering the water-cement ratio, TRIMIX accelerates setting, thus shortening the time ordinarily required to protect concrete with covers and artificial heat.

Result: TRIMIX cuts construction costs by saving time between finishing operations . . . allows concrete surfaces to be walked on and additional work done within a few hours after the concrete is poured — *in winter* as in other seasons.

Use TRIMIX in all concrete work to make good concrete *better* and speed finishing operations; also in stucco construction, mortar mixes, patching and maintenance, grouting, foundation walls and footings, floor construction, etc.

See SWEET's for further information, or for descriptive folder write Dept. E-11.

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Floor Treatments • Waxes • Paints and Protective Coatings • Concrete and Mortar Admixtures • Waterproofing and Dampproofing • Caulking Compounds Roof Coatings

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Building Products Division, **L. SONNEBORN SONS, INC.,** New York 16, N. Y.

In the Southwest: Sonneborn Bros., Dallas 1, Texas

Men and Jobs

Col. Frank L. Beadle, Corps of Engineers, U. S. Army, on Oct. 15 became district engineer, Duluth District, Corps of Engineers, vice **Col. H. R. Cole** who has been transferred to the Wilmington, N. C., district office.

Col. Beadle

Colonel Beadle, 50, is a graduate of the U. S. Military Academy and was commissioned a second lieutenant in the Corps of Engineers in June, 1922, and took his bachelor of science degree in civil engineering at the University of California in 1927. He served in the first world war, and was an instructor in mathematics and civil engineering at West Point, 1927-31. He served with the 6th Engineers at Fort Lewis, Wash., 1931-34. He was an engineer in the Army Forces in the South Pacific, 1942-43, and was chief of staff to the Island Commander, Tinian, 1944-46. He was excutive officer of the Portland, Ore., district 1946-47.

G. Mianulli is a consulting structural engineer at 44 Court Street, Brooklyn, N. Y. He was formerly with James Allen Tuck and was with the U. S. Navy in Brooklyn as designing structural engineer.

G. G. Werner, Jr., a partner of Malcolm Pirnie Engineers, New York, is in Athens, Greece, as assistant project director for Atkinson-Drake-Park in connection with reconstruction of war damage to railroads, highways and other structures.

George E. Purmort, a construction engineer for the Robert L. Reisinger & Co., Milwaukee, Wis., for 10 years prior to his government work as supervising engineer on construction, has again affiliated himself with that firm.

C. Stribling Snodgrass, a director of Bechtel Corp., will now serve as vice-president in charge of engineering, according to an announcement by S. D. Bechtel, president. Snodgrass will have charge of all engineering and development activities, with emphasis on the design and engineering of refineries and chemical plants. Snodgrass continues as vice-president and director of Bechtel

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EASY TO USE!

THE TEMPOTOOL "22" WITH SAFETY SHIELD

Pats. Pending

THE NEW TEMPOTOOL

The overwhelming demand for the new TEMPOTOOL has proven beyond a doubt that it fills a long standing need for a faster, more efficient, fastening method.

Electrical contractors, civil engineers, public utilities, highway and railroad construction firms, and industrial maintenance men alike are enthusiastic in their acclaim for TEMPOTOOL and its proven ability to save time and money on the job. In some cases TEMPOTOOL has solved special fastening problems that have troubled whole industries for years.

A new brochure on TEMPOTOOL is just off the press. Send for it, and find out how you, too, can use the revolutionary new TEMPOTOOL in your business.

THE TEMPOTOOL PRINCIPLE OF OPERATION

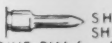
TEMPOTOOL employs the power of an exploding powder charge to drive a "holding stud" into steel, concrete or masonry.

The high velocity of the stud is such that it imbeds itself firmly in steel, concrete or other relatively tough materials. It will withstand many hundreds of pounds of direct pull and is highly resistant to vibration. The holding principle of the stud is similar to that of a nail—increased a thousandfold.

Three powder loads for TEMPOTOOL are available for "controlled power" on the job.

STANDARD STUDS FOR THE "22"

LONG SHANK DRIVE PIN for direct fastening of steel to concrete or masonry.



SHORT SHANK DRIVE PIN for direct fastening of steel to very hard concrete or to mild steel up to 3/8".

LONG SHANK THREADED STUD for use where stud is to act as an anchor. Objects may be attached with a common nut.

SHORT SHANK THREADED STUD also used with a standard nut in same manner as the long shanked threaded stud.

Other type studs available on special order.

FOR THE WHOLE STORY send for the new TEMPOTOOL brochure.

SOLD NATIONALLY THROUGH RECOGNIZED DISTRIBUTORS ONLY

TEMPOTOOL "38"

For heavier fastening jobs that are beyond the capacity of the less powerful "22". The "38" will penetrate mild steel up to 5/8" thickness. Uses studs similar to those used by the "22" plus an internally threaded stud for the attachment of threaded rods. The "38" also has built-in safety and anti-recoil features.

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TEMPOTOOL

TRADE MARK REG. U. S. PAT. OFF.

THE NEW *Powder-Actuated* HAND TOOL

Clean Comfortable LIVING on the JOB!

FOR ALL CONSTRUCTION PERSONNEL!

A modern PRARIE SCHOONER provides clean, comfortable "on the job" housing, at lowest cost. The best beds, good cooking facilities, refrigeration, warmth in the severest weather, storage for clothing and all living essentials. In the roomy "SCHOONER" there's space left over for desks, files, drawing equipment, etc. It is ruggedly built and tows *anywhere* with *any* car.

CONTRACTORS ATTENTION!

You can get better men and keep them longer by providing clean, quality housing at the job site! Eliminate costly construction and salvage of temporary housing. Move key men from one job to another without delay.

There is a PRAIRIE SCHOONER dealer near you.

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International Corp., and as a director of International Bechtel Inc. He will make his headquarters in San Francisco, directed by C. C. Steward, chief engineer.

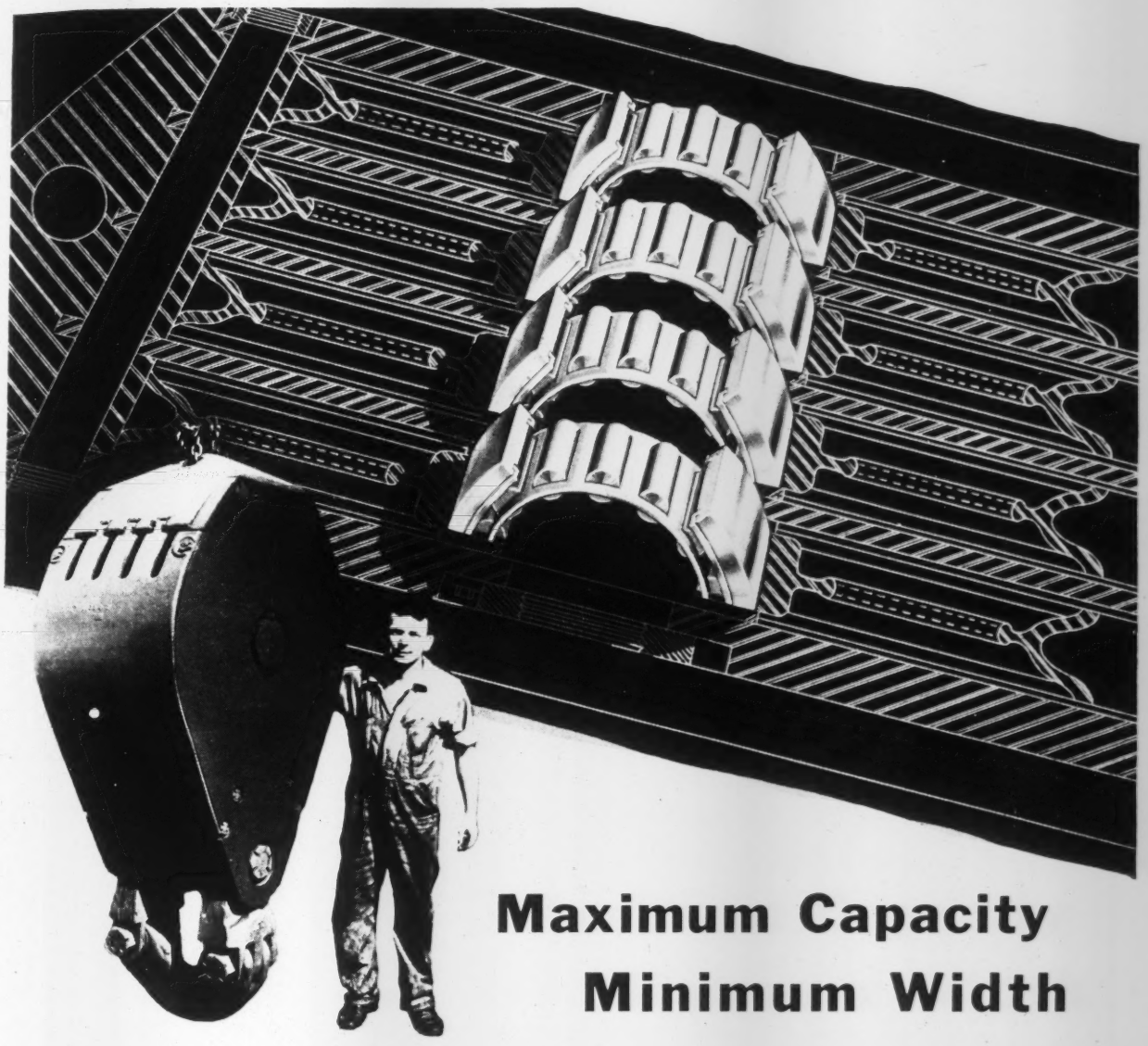
The names of five men playing key roles in the construction of the first peacetime nuclear reactor (atomic pile) at Brookhaven National Laboratory on Long Island have been announced by Wells N. Thompson, project director and vice-president of The H. K. Ferguson Co., industrial engineers and builders of Cleveland, New York and Houston. They are: **Frank W. Buck**, chief engineer; **S. C. Willis**, general superintendent in charge of construction; **Norvon Clark**, personnel manager in charge of employment, labor relations and security; **T. W. Ryan**, comptroller, and **Dennis L. Ryan**, assistant to the project director.

C. E. Arnold has been appointed surveyor and county engineer of Los Angeles County, Calif., by the board of supervisors, succeeding **Alfred Jones**, retired. Mr. Arnold has been chief deputy surveyor and county engineer since 1935. He attended the University of California and was graduated in the college of engineering in 1909. After graduation he became assistant engineer for Sacramento Valley Irrigation Co., Willows, Calif., engaged in planning and construction of irrigation and drainage works. He worked successively as assistant to the surveyor of Yolo County, Calif.; city engineer of Woodland, Calif.; engineer for several private companies, and as construction engineer in the surveyor's office in Los Angeles.

C. E. Arnold

Simon H. Ingberg, chief of the fire resistance section of the Bureau of Reclamation since 1920, retired recently after more than 30 years of bureau service. Mr. Ingberg directed research and introduced experimental technics that have been responsible for placing fire protection upon a scientific and mathematical basis, including studies of fire severity within buildings and behavior of structural columns during a fire. Among other investigations under his direction were flame-proofing of textiles, chimney and roof constructions, and fire-resistive properties of building materials and constructions.

Norman C. Bird, chief engineer for the Illinois department of aeronautics, has announced that nine graduate civil



Maximum Capacity Minimum Width

Streamlined shape and rugged construction speak for the stamina of this new McKissick Traveling Block. But a look inside, where four Hyatt Roller Bearings carry a 200-ton load, shows how the bearings contribute to highly efficient design and operation.

These bearings are Hyatt Hy-Load Type, which feature high radial capacity for minimum bearing width—making possible the narrow sheaves for block compactness which, in turn, permits maximum derrick working space.

The bearings are used without inner races, the rollers operating directly upon the hardened surface of the pin. Three advantages result: larger pin size for given bearing rating—easier assembly because there are no inner races to apply—better lubrication.

Wherever Hyatts are used you'll find sweeter design and sweeter performance, like this. It's a combination that has won for Hyatt and Hyatt customers millions of friends not only in the oil field, but in mining, transportation, agriculture, construction, and throughout all industry.

It will pay *you* to look into the advantages of Hyatt Roller Bearings for your product, and Hyatt Engineering Service is available to help you do it without cost or obligation. Write to Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

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RESTORATION—and strengthening of weak, ruptured or impaired structures. Foundations, Bridges, Tunnels, Dams, Reservoirs, Sewers, Pipelines, etc; etc.

SOIL STABILIZATION—by deep subgrade consolidation of filled ground, silt deposits or other unstable ground formations, to prevent or correct structural deficiencies from subsidence of ground supports.

SEALING—of subterranean flows of water under buildings, dams, and other structures. Construction of submerged Dams, Groundwater control for Mines, Subways, Aqueducts, Seawalls, etc.

CEMENTATION—of loose or fractured rock strata, gravel or rip-rap deposits to prevent danger from slides, falls, or infiltration.

PRESSCRETE FOUNDATION PILES—built-in-place without vibration, noise or ground disturbance. No limits to length, size or shape. Can be used in restricted places, low headrooms, for underpinning of weak foundations and structures.

PRESSCRETE ENCASING—For repair or protection of maritime foundation piling attacked or endangered by teredos, dry-rot, fire, rust, impact, abrasion or other marine hazards—Applied without interference of structural service operations.

Write for complete information, give description of kind, location, and approximate extent of required work. Contracts taken everywhere.

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OPERATING machinery for bridge installations, dams, locks and gates should be dependable and positive in action above all else. Earle "oversize" construction and automatic lubrication minimize wear and provide year after year service with little or no maintenance. Backed by years of experience, Earle produces operating machinery that is known as "trouble-free" by bridge and water works engineers who specify it.

Our specialists will gladly work with you to solve your gear or machinery problems—get in touch with us now. If you want further information first, send for our NEW catalog containing Earle operating machinery. The EARLE GEAR AND MACHINE CO., Main Office: 4717 Stenton Ave., Phila. 44, Pa.; Sales Offices: 149 Broadway, N. Y. 6; 901 Davis Ave., Pittsburgh 12, Pa.

*INCORPORATED IN EARLE OPERATING MACHINERY

EARLE GEARS

engineers have been added to his staff, to be employed in the airport development program. They are: Edward H. Gilbert, of Loudonville, Ohio, Michigan State college; O. R. Bellucci, Barre, Vt., Norwich University; Gilbert D. Henning, Effingham, Ill., University of Illinois; M. J. Darnell, Memphis, Tenn., University of Kentucky; H. S. Main Jr., New York City, Clarkson Institute; Ralph D. Mudgett Jr., East Hartford, Conn., M.I.T.; Nils Klutsdal, Champaign, University of Illinois; W. B. Ricks, Effingham, Ill., Mississippi State college; W. R. Cooke, Springfield, Ill., University of Illinois.

Clyde Pace, an engineer for the Missouri Resources and Development Commission, has been named head of the commission's aviation section to succeed **Eugene V. Fryhoff,** resigned.

Frederic W. Mellor, engineer and architect has joined The Foundation Co., engineers and builders of New York, as assistant to the president. Mr. Mellor, who recently resigned as general sales manager of The H. K. Ferguson Co., Cleveland, has participated in some of the country's largest industrial developments of the last 25 years.

F. W. Mellor

During the war he served as chief of the Chemical Warfare and Explosives Plants Branch in the Corps of Engineers, supervising design and construction of Chemical Warfare Service manufacturing facilities valued at several hundred million dollars. With The Foundation Co. operating in this country and abroad, Mr. Mellor will concentrate on sales in the industrial and public utilities fields.

Richard J. Hale, of Missoula, who has practiced engineering in Montana for 25 years, has been appointed to the state board of registration for civil engineers and surveyors.

Norman Kruchkow, formerly an engineer with the Corps of Engineers, New York district, has resigned to become assistant plant manager and estimator with M. Gottfried, Inc., roofing, sheet metal and air conditioning contractors in Stamford, Conn.

Herbert G. Poole has been named superintendent of the municipal water, streets and sanitation department at Carthage, N. C., succeeding **John A. Lang,** resigned.

HOW TO MAKE CONSTRUCTION JOBS SAFE

Safety starts where the construction job starts — on your plans. Spot accident hazards at the blueprint stages, and you save valuable time, money, and human lives on the job itself.

Helping you to stop accidents before they get started is Liberty Mutual's job. Specialists on our staff of loss prevention engineers have years of experience in construction work. They know your business and talk your language. And having studied thousands of accident cases, they can tell you just where and how your accidents are likely to happen. They can help you take direct, simple action to prevent them — before they leave the "paper" stage. Leading construction men from coast to coast have found that Liberty Mutual helps to save them money, speed up their jobs, and prevent injury.

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As the leading writer of construction insurance in America, Liberty Mutual knows how to protect contractors fully on every job . . . how to handle claims fairly and promptly. With our own claimsmen working from 108 branch offices, we can give you quick service any time, anywhere, and follow up and control claims after you've left the job.

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★ *We work to keep you safe* ★

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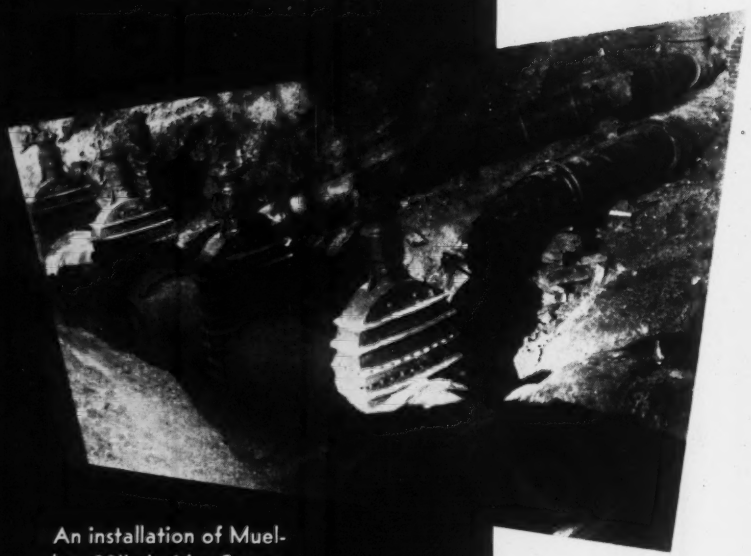

An installation of Mueller 30" Inside Screw, Spur Geared Valve with By-Pass.

Since most Gate Valves are usually buried, water works men want to be sure that the ones they install are going to STAY THERE!!! That simply means that the BEST valves they can buy and install will be the cheapest for them — valves that will operate over the years without binding — valves that will open widely and close tightly without leaking and operate year after year without constant maintenance and repair.

These are some of the reasons why Mueller Gate Valves have been widely accepted by alert-minded planners and operators of water and sewage systems. All Mueller Gate Valves have extraordinary thickness of section and are fully bronze mounted. The exclusive 4 Point Wedging Mechanism prevents warped discs and the high tensile strength bronze stems with accurately cut threads open and close the valve with a minimum of effort. The standard line of Mueller Gate Valves includes all sizes from 2" to 48" with either rising or non-rising stem, hand or power operated and with or without by-pass valve. Consult Mueller Co. for engineering advice, recommendations or quotations. There is no obligation.

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Elections and Activities

Earl Grump of Wilson, N. C., assistant division engineer of the North Carolina State Highway Department, has been elected president of the State Employees Association succeeding W. B. Ferguson of Burnsville. Other officers are: T. F. Royall of Wadesboro, vice-president; and Otis Banks of Raleigh, secretary.

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City Manager P. M. Burdette of Asheville, N. C., has been appointed a member of the North Carolina State Commission to Study Stream Pollution. The appointment was made by Governor Gregg Cherry and Burdette succeeds the late Walker Lyerly of Hickory. The term expires June 21, 1952.

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Welded Design Eliminates Dead Weight in 4-Story Structure

By Roy L. Brown, Partner
Brown's Machine Shop, Sedalia, Mo.

THE all-welded design of our new four-story building now under construction has eliminated structural dead weight and thus increased each floor's capacity to carry heavy machinery loads. The reduction in steel and speedier erection with arc welding have also cut construction costs.

We designed the 92 x 120′ building for our own use as an automotive machine shop. All welding was done with "Fleetweld 47" electrode.

Double pipe columns reinforced with concrete are used throughout and are reported to be superior to conventional upright floor supports. Rising from the reinforced concrete basement floor to support the first floor are columns made of 10″ steel pipe with 6″ pipe inside, both filled with concrete and welded to a 2″ bearing plate.

ALL-STEEL FLOOR

Fig. 1 shows a similar 10″ double pipe columnar support for the second floor being welded to the top flange of a 24″ I beam at the first floor level. This column contains a 4″ pipe. The columns for upper stories are 7″ pipe with 4″ pipe inserted. In Fig. 1 bar joists have been welded to the I beams. Steel deck flooring was later welded to the bar joists. During construction this floor supported a truck and hoist to raise a 40-ft. beam weighing 4 tons.

Fig. 2. Two welders weld heavy beams simultaneously to avoid distortion.

Fig. 2 shows a vertical weld being made to join a curved lintel section to a straight lintel. Two welders are simultaneously welding on each side of the joint to maintain proper alignment. This procedure was used for welding all large beams. The curved lintel was shop-fabricated and hoisted into position for welding to straight lintels 80′ and 35′ long.

Fig. 3 shows the framework for the elevator penthouse and loading dock. Here 12″ door channels were formed from ¼″ steel plate and welded to a 13″ Z-bar, and 6″ x 6″ x ⅜″ angles were welded to the Z-bar to complete the lintel over the loading dock door.

Fig. 1. Welding pipe column to first floor I beam. Column has a smaller pipe and concrete inside.

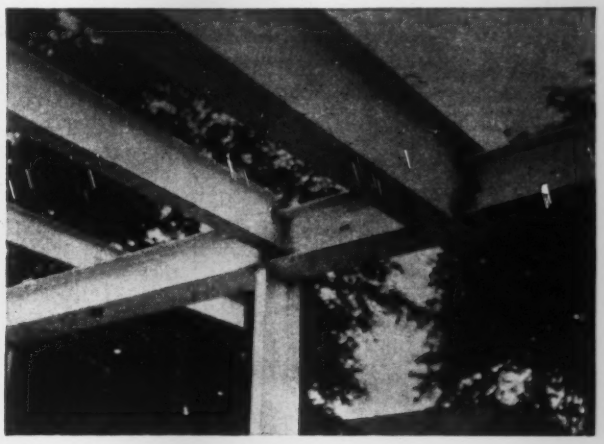

Fig. 3. Framework for loading dock contains channels, I beams, angles and Z-bar.

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READY FOR NEXT WAR

Establishment of an atomic bomb shelter for use by Chicago Tribune employees in event of an atom bomb attack on Chicago was announced Sept. 25 by the Tribune. A second basement storage area with walls and ceilings of heavy concrete and steel beams has been designated the primary atomic shelter. Directions for reaching the refuge are being prepared for every office and department of the Tribune.

Preliminary studies indicate that the shelter should be effective protection for the maximum of 3,000 persons who might be forced to use it against the primary blast and the super-earthly heat released from even a near-by atomic bomb explosion. Steel and concrete structures in Japan resisted atomic blast and heat better than any other type of construction.

Keith Capron, building manager of Tribune tower, is now outlining multiple routes for entering the shelter. Other problems to be taken up include the installation of an auxiliary lighting system for use should Chicago's electric power fail in such an attack and the providing of ventilation and sanitation facilities.

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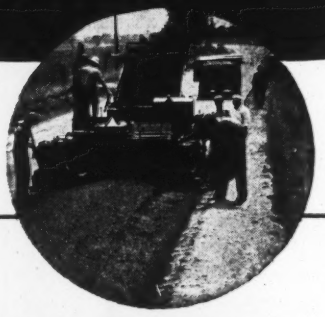

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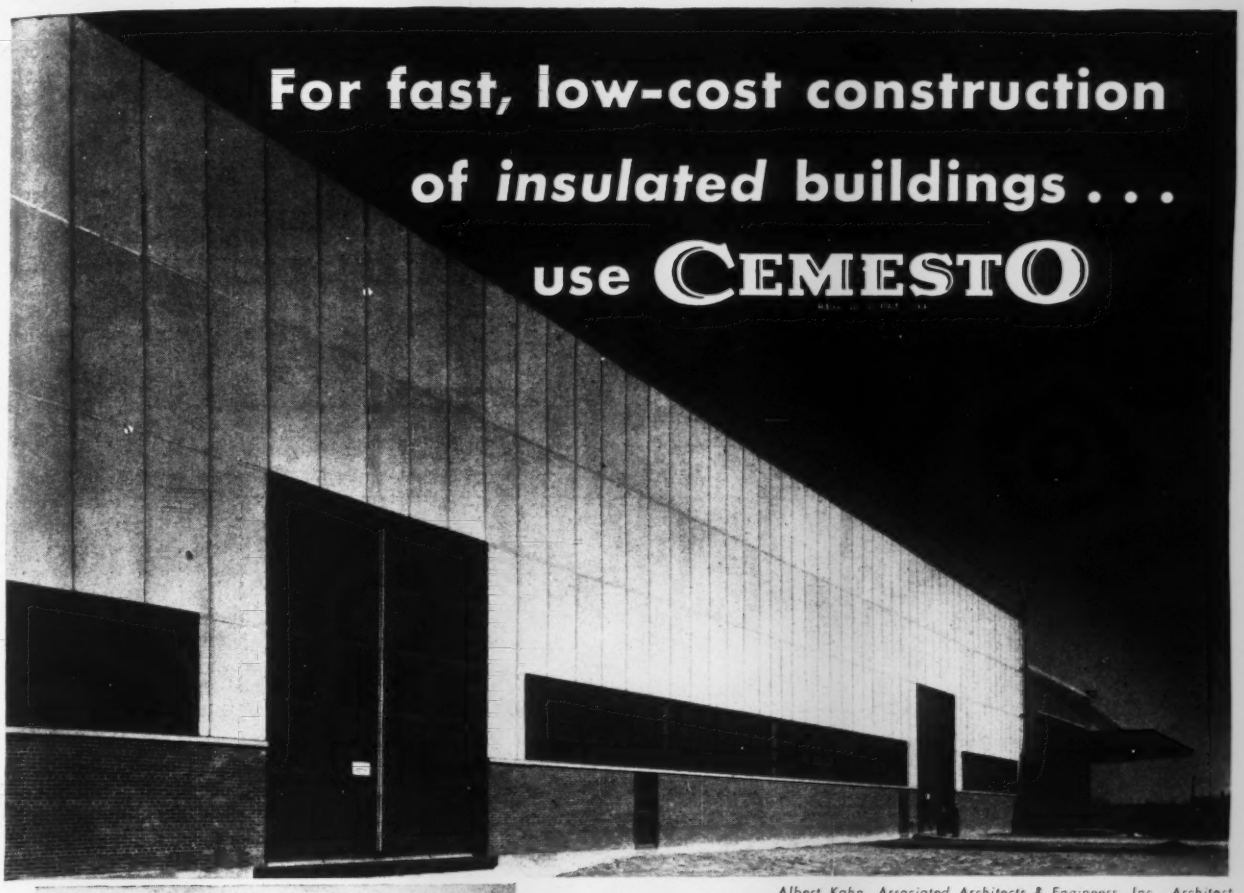
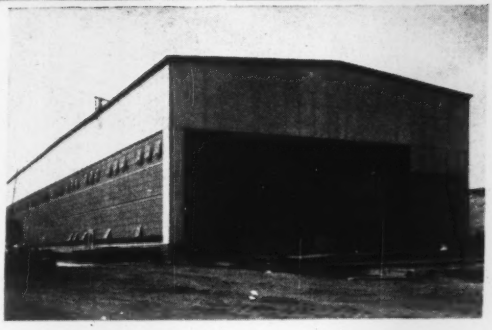
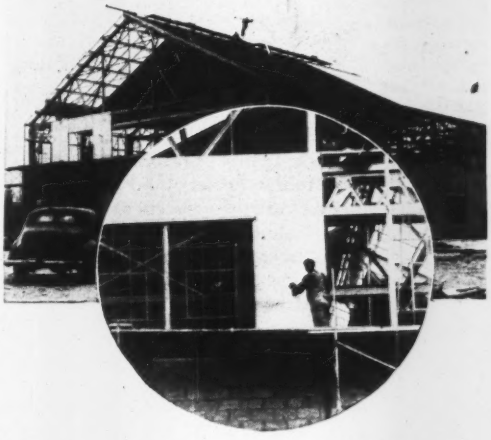


Albert Kahn, Associated Architects & Engineers, Inc., Architect





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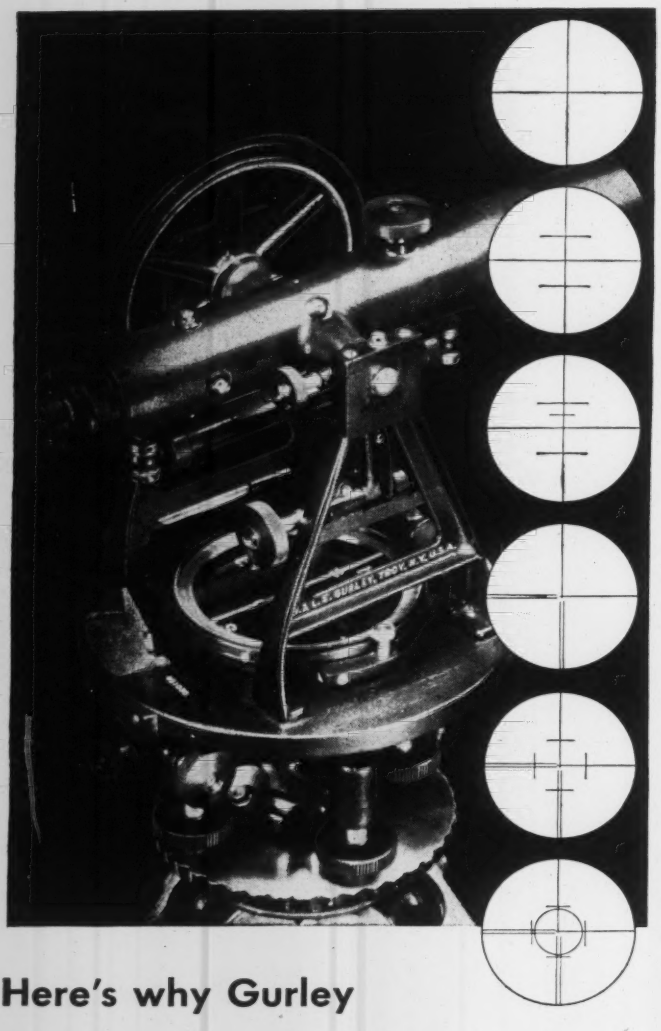

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O. Parallel horizontal and vertical lines combined with regular cross-lines.

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S. Solar reticle. A combination of "O" and "T" with a circle 15′ 45″ radius for centering the sun's image.

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At the annual meeting of the Iowa Engineering Society in Des Moines next February there will be a program covering every phase of Iowa Flood control.

Arizona Sewage & Water Works Association, at its annual fall conference, held at Grand Canyon introduced a new feature, an "Operators' Roundup" in which experts endeavored to answer questions mailed in advance covering difficult practical points in operating. Secretary George W. Marx had mailed requests for questions to all members a month in advance and replies were sent in unsigned. The group organized its own section of American Water Works Association, with the same officers as the convening group, and elected as its representative on the national board of directors A. W. Miller, state representative H. W. Johns-Manville Co.

R. K. Rouse, of Greenville, has been elected first president of the South Carolina Society of Professional Engineers. Other officers are Bruce Barber, of Columbia, first vice-president; John H. Disher, of Charleston, second vice-president; and Alexander C. Crouch, of Greenville, secretary-treasurer.

At the recent annual meeting of the Washington Building Congress, Washington, D. C., John G. Scharf, president of Prescott Construction Co., Inc., general contractors, was installed as president. Other officers are: Louis-

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Seven of a battery of eighteen Gardner-Denver WBK-500 two-stage all-water-cooled compressors, supplying air for the construction of the new Manhattan-Brooklyn Vehicular Tunnel. Compressors were installed on a barge to eliminate the cost of permanent installation.

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The WBK-500 is a quality compressor in every part. Timken roller bearing crankshaft. Duo-plate valves. Full force feed lubrication to all bearings. Powered by a D13000 Diesel engine. These are only a few of the features which put this portable at the head of its class.

There's a Gardner-Denver Portable Compressor for every job—and Gardner-Denver representatives are available for advice and consultation throughout the country.

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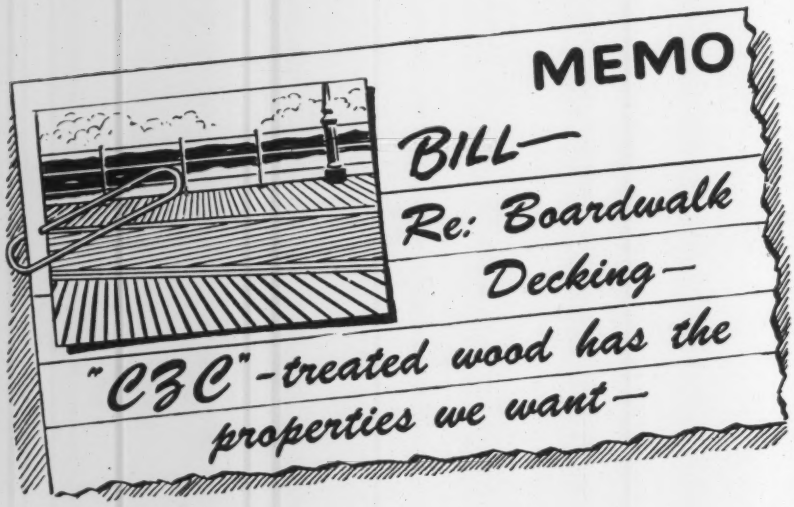

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Justement, architect, P. Y. K. Howat, president of Howat Concrete Co., and William F. Nelson, masonry contractor, vice-presidents; George V. Graham, A. P. Woodson Co., secretary; and W. A. H. Church, W. T. Galliher & Bro., Inc., treasurer, all of Washington, D. C. Three new directors are William K. Karsunky, consulting engineer; Thomas H. Locraft, Murphy & Locraft, architects; and M. C. MacKinnon, Super-Concrete Co.

Prof. Frank Kerkes of Iowa State College, Ames, Ia., president of the Iowa Engineering Society, has asked various groups of engineers working on Iowa flood control problems to have their recommendations ready to submit at the society's annual convention in February, 1948. Professor Kerkes said the symposium on flood control in Iowa will cover soil conservation, public health, power development, recreation and flood prevention and repair. The recommedations developed at the February meeting in Des Moines will be submitted to local, state and federal authorities dealing with flood control.

R. P. Reece of Winston-Salem was nominated without opposition for president of the North Carolina Society of Engineers at its recent annual convention at Asheville, N. C.

Nominations of officers for the Society to be voted on at the group's winter convention at Charlotte in January are: President, R. P. Reece of Winston-Salem; vice-president, T. C. Cooke of Durham, and William E. Henry of Charlotte; for directors—District No. 1, Martin Swartz of Greenville and Worth B. Baldwin of Fayetteville; District No. 2, P. D. Davis of Durham and F. D. Wheeler of Raleigh; District No. 3, W. F. Humbert of Spray and Charles M. Sprinkle of Winston-Salem; District No. 4, Glenn E. Park of Charlotte and J. R. Purser, Jr., also of Charlotte.

The West Virginia Sewage and Industrial Wastes Association was recently created to advance the work of the sanitary engineers in that state. Kyle Cruce, president of the Bluefield, W. Va., Sanitary Board, has been elected president of the new organization.

Other officers are Paul Simmons, Bacteriologist with the Weirton Steel Co., first vice-president; Edward Settle, consulting engineer of Charleston, W. Va., second vice-president; R. G. McCall, associate engineer with the West Virginia State Department of Health, secretary, and Kenneth S. Watson, engineer of the West Virginia State Water Commission, National Director to the Federation of Sewage Works Association.

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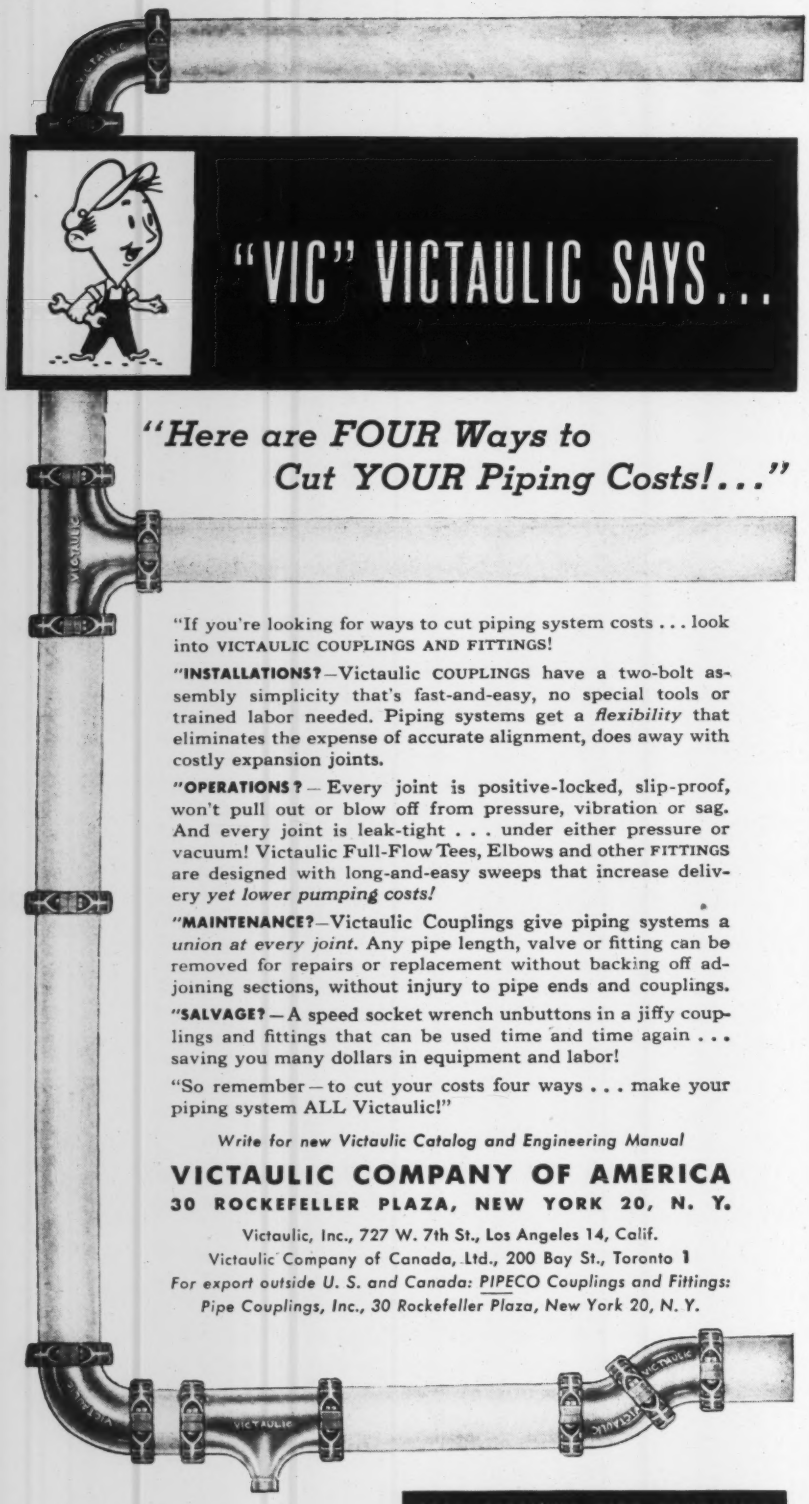
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Engineering School News

G. A. Riedesel has been promoted to professor and head of the department of civil engineer at the University of Idaho. He has been on the university staff since 1940 and for the last two months has been engineer on a faculty homes project.

Gustave J. DeTraglia has been appointed assistant professor and head of the engineering drawing department of Mohawk College, Utica, N. Y. He formerly was a draftsman in the department of engineering, city of Utica, and later served as a junior engineer for WPA.

Alfred R. Jumikis has joined the School of Engineering at the University of Delaware, Newark, Del., as assistant professor of civil engineering. Having received an engineers' diploma from the University of Latvia in 1937, he returned to his alma mater for the degree of doctor of engineering in 1944.

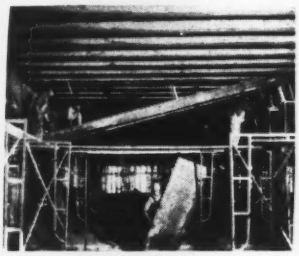
Another addition to the faculty is Charles G. Taylor, a graduate of Syracuse University, who is instructor in civil engineering. Two graduate assistants in the School of Engineering are Walter J. Dougherty, a graduate of the University of Delaware in 1944, and Milton W. Harper.

Giles G. Green has been appointed assistant professor of civil engineering at the Cooper Union school of engineering. Professor Green served during the war as a major in the U. S. Army Corps of Engineers, and is a specialist in structures and mechanics of materials. He was graduated in 1937 with honors from The Cooper Union. He was granted a scholarship for graduate work at M. I. T., where he received his M. A. Later he did additional graduate work at Cornell University as a McMullen scholar.

New additions to the faculty of the North Carolina State College school of engineering at Raleigh, N. C., include: Henry E. Griset of Brooklyn, N. Y., and Alfred E. Williamson, Jr., of Laurel, Md., who have been named associate professors of civil engineering; Gerald Palevsky of New York City, William Boyer of Washington, D. C., Francis F. Funk of Roanoke, Va., Henry L. Kingsbury, Jr., of Bathe, Me., Leonard R. Mann of New York City, and William Henry Semple of Easton, Pa., who have been appointed instructors in civil en-

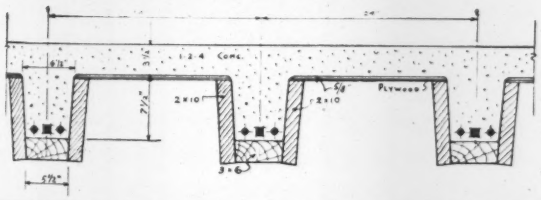
"Plywood was Specified to Achieve Smooth, Easily-Painted Surfaces"

. . . says *Architect Silas E. Nelsen*



At left: Workmen strip plywood forms from lower level. *Below*: Cross-section of construction detail. General contractor was the Bonnell Construction Company, Tacoma.

Cross Section Clear Span 23'-0"



THE photograph above shows workmen laying plywood forms for the joist and flat-slab construction utilized in building a new sales and service center for the Mueller-Harkins Motor Company, Tacoma, Washington, Buick distributor. Architect Silas E. Nelsen, Tacoma, says: "The under-side of the joist and flat-slab span formed the ceiling of the building's lower level. A smooth, easily-painted surface was desired. I specified Douglas fir plywood forms because they were inexpensive, yet fully capable of achieving the desired effect." Plywood concrete forms have many advantages. The material is strong and durable, making possible multiple re-use of panels. Plywood is light, easy to work and handle. Sanded plywood panels result in smooth, fin-free and rust-free concrete surfaces which reduce finishing time and costs.

Plywood's Many Advantages Keep Demands Greater Than Present Supply

Douglas fir plywood production is now greater than in prewar years. Today's demand, however, is unprecedented, and available raw material is the controlling factor in attaining greater output. The resulting uneven demand-supply ratio means that plywood may not always be available at any given time or place. For price and delivery information, see your regular source of supply. Technical data may be secured from the Douglas Fir Plywood Association, Tacoma 2, Washington.

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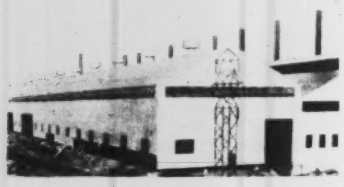

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gineering; R. K. Shumaker of Rockwood, Pa., and James E. Deas of Macon, Ga., who have been named assistants in engineering research; and George Miller Armstrong, Jr., of Florence, S. C., who has been named research associate in engineering research. Resignations include R. E. Stiemke, who has given up his post as associate professor of sanitary engineering.

Eugene J. Daly, Kansas City, Mo., bridge design engineer, has been appointed an assistant professor in civil engineering at the University of Illinois. He has had 11 years experience in bridge design, hydrology, bituminous paving, soil mechanics and county planning. An honor graduate of the Missouri School of Mines, Rolla, Mo., in 1936, he served with the United States Engineers offices in Memphis, Tenn., and Little Rock, Ark., from 1936 until 1941. He served three years as a lieutenant in the Civil Engineering Corps of the Navy. Edwin R. Bretscher, design engineer, Kansas City, Mo., also has been appointed an assistant professor of engineering. He served as civil engineer for the St. Louis and Southwestern Railroad and is a graduate of the University of Missouri, 1937.

Thomas Klingle, division engineer for the Soo Railroad in Minneapolis, has accepted a position as an assistant professor of civil engineering at the University of Minnesota. He will be in charge of the surveying and railroads courses.

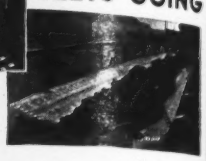
Wiley W. Souba, instructor in mathematics and mechanics at the University of Minnesota, has become an instructor in civil engineering at Washington State College.

W. L. Sagar, professor of civil engineering at the University of Toronto, has been promoted to lieutenant-colonel and appointed officer commanding the University of Toronto contingent of the Canadian Officers Training Corps. He saw service in both world wars.

The college of engineering, University of Illinois, during this academic year will have a faculty and staff of 468, including full-time and part-time members. A total of 58 men were promoted in rank and salary. Melvin L. Enger is dean.

Men who were graduated from Johns Hopkins University last June are earning an average salary of $211 a month, university officials have revealed. Those with an engineering degree had a slight edge over those with an arts and science or business degree. The average engineer's monthly salary was $237, against $200 earned by those with an arts and

KEEP YOUR CONVEYOR BELTS GOING



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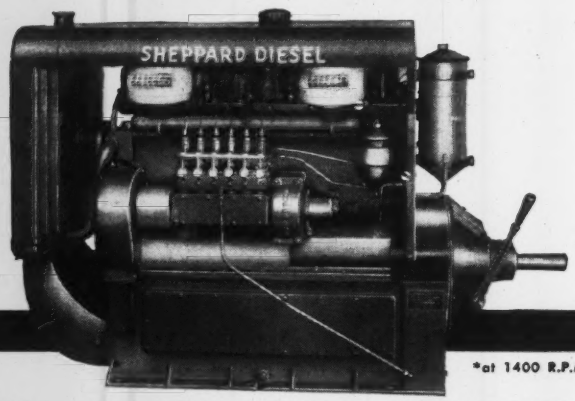
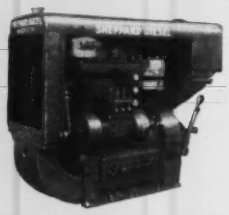


*at 1400 R.P.M.

Model 12 – 6 cylinders, 50 H.P. **Model 12D – 6 cylinders, 62 H.P.***



Model 6A-1 – 3 cylinders, 25 H.P.
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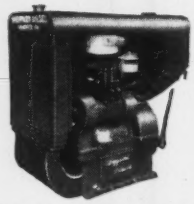

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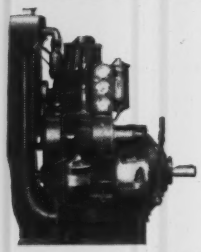
Model 13D – 2 cylinders, 18 H.P.



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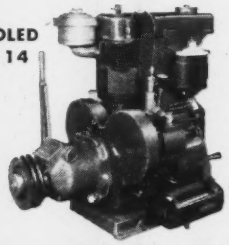

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science degree, and $[illegible] by those with a business degree.

Offering upper divisi[illegible] work with an A.B. degree in engineering for the first time, San Jose State College in California has added several instructors to its engineering department. Ralph Smith, head of the engineering school, has announced the addition to the faculty of Maurice A. Buckley and O. Allen Israelsen in civil engineering. A major piece of equipment purchased for the expanded department was a Reihle Universal machine to test compression, tension and transverse bending of metals, plastics and other materials. Record enrollment in the department this year is 350.

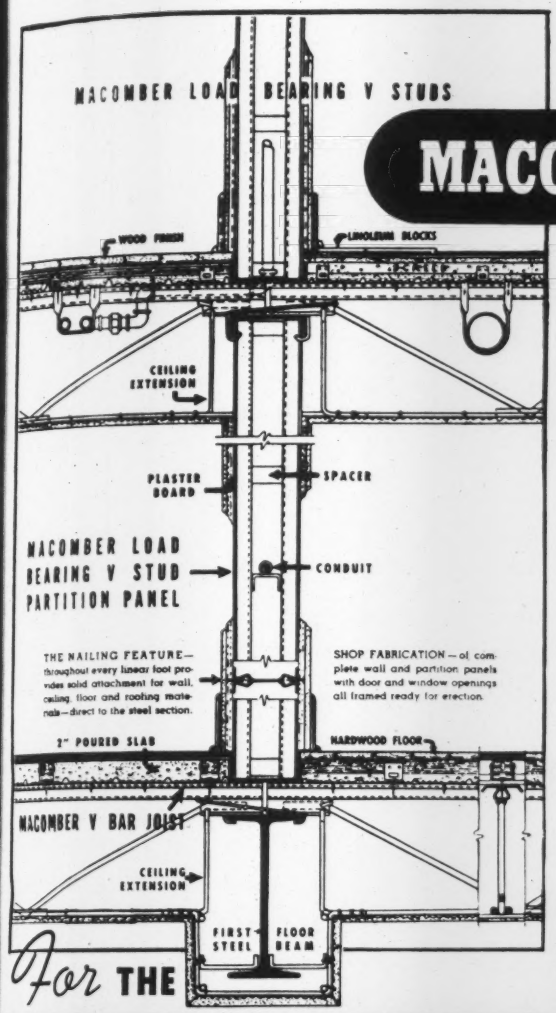
The school of engineering of the University of Buffalo, N. Y., has 41 full-time members in its faculty. The school, established two years ago, now has nearly 1300 students. Clesson H. Field, who formerly taught civil engineering at the University of Pennsylvania, is the new associate professor in engineering. For six years he was vice-president and acting chief engineer for the L. A. Harding Construction Corp. and since 1932 he has been engineer for Amherst, N. Y. Eugene A. Melvin and Peter G. A. VanderMeer have been appointed instructors.

Clinton E. Jones of Tarboro, N. C., has been named assistant dean of engineering at North Carolina State College, Raleigh, N. C., to handle industrial and commercial contracts for the school in the employment of engineering graduates.

Prof. Arthur B. Bronwell, Northwestern University, Evanston, Ill., has been appointed secretary of The American Society for Engineering Education. The headquarters of the society is to be moved from the University of Pittsburgh to Northwestern University.

Georgia Tech has increased its faculty in the engineering divisions by 38 percent for the fall quarter. Dean Cherry L. Emerson has announced. Eight departments have additions of 15 full-time and 14 part-time members. Wilfred M. Honour, Georgia Tech and University of Illinois, has been made associate professor in the department of civil engineering.

Percival S. Rice of Wellesley, Mass., has been appointed assistant professor of civil engineering at the Tufts College School of Engineering, Medford, Mass. William W. Fagan of Roxbury has been appointed an instructor in civil engineering.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THE NAILING FEATURE—throughout every linear foot provides solid attachment for wall, ceiling, floor and roofing materials—direct to the steel section.
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2" POURED SLAB
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Shown opposite is a cross section of the Load Bearing Partition illustrated below. These units are made in panels for easy handling. All service lines are hidden within the panel and plaster base is nailed to steel stud sections.

These steel framing units are now being fabricated for multi-story apartments in many localities. They are used to speed up framing time. When used in conjunction with V Bar Joists and a poured slab with plastered ceiling below, they reduce insurance rates considerably. Light weight Roof Trusses complete the steel framing.

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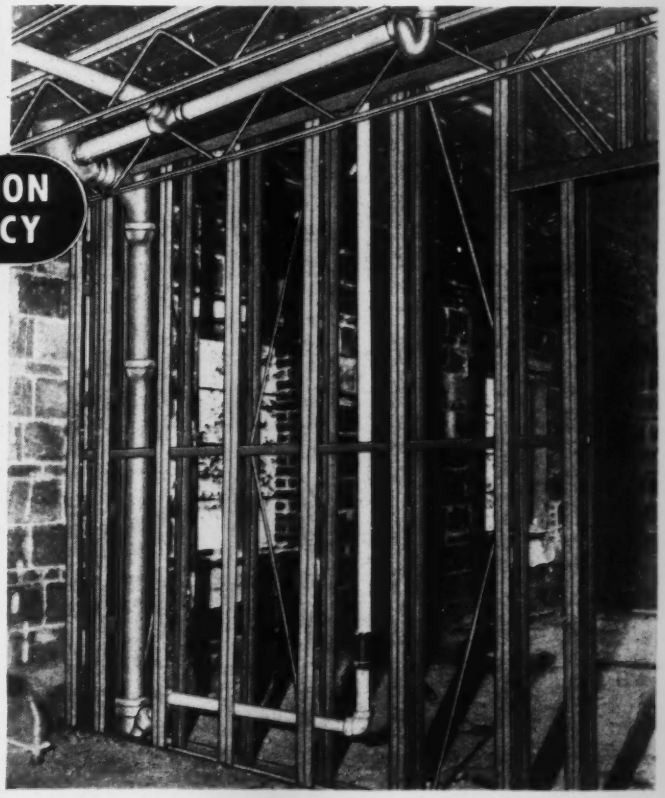

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LOAD BEARING PARTITIONS

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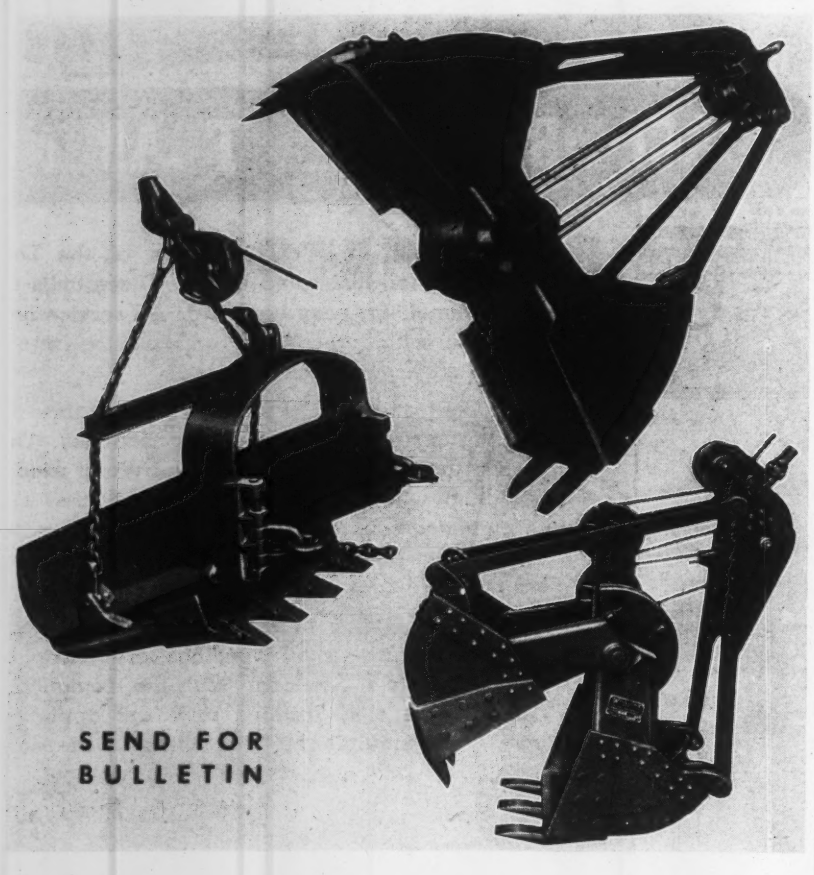

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Reports and Pamphlets

(*Continued from page 1524*)

INFLUENCE OF PARKING ON ACCIDENTS—By W. S. Smith. Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

MODERN DESIGN REDUCES ACCIDENTS—By H. C. Coons. State Highway Department, Detroit, Michigan.

COMPILATION OF RENTAL RATES FOR CONSTRUCTION EQUIPMENT—Fourth Edition—Associated Equipment Distributors, 1900 Eye Street, N. W., Washington, D. C. $2.

THE NATIONAL APPRENTICESHIP PROGRAM—United States Department of Labor, Apprentice Training Service, Washington, D. C.

CALCULATING MACHINES—By D. R. Hartree. Cambridge University Press, England; The MacMillan Company, New York 11. 75c.

REPORT ON HIGHWAY ORGANIZATION AND ADMINISTRATION—Bulletin No. 3 Highway Research Board, Washington, D. C.

JOHN HENRY TOWNE: A Builder with Perspective—By W. G. Carey. Princeton University Press, Princeton, N. J.

THE FWA PLANNING AID PROGRAM IN TENNESSEE—1945-1947—Tennessee State Planning Commission, 432 Sixth Ave., North, Nashville 3, Tenn.

THE CAUSES AND EFFECTS OF SEDIMENTATION IN LAKE DECATUR—Bulletin No. 37—By C. B. Brown, J. B. Stall and E. L. DeTurk. Department of Education and Registration, Urbana, Illinois.

SLIDE RULE SHORT CUTS—2nd Edition—By W. P. Miller, 536 F St., San Diego, Calif. $1.50.

MANUAL OF UNDERPASSES AND SERVICE TUNNELS—Armco Drainage & Metal Products, Inc., Middletown, Ohio.

TWENTIETH ANNUAL HIGHWAY CONFERENCE OF THE UNIVERSITY OF COLORADO—Series No. 20. University of Colorado, Boulder, Colo.

PLANNED LIGHTING PROGRAM FOR INDUSTRY—Edison Electric Institute, 420 Lexington Ave., New York 17.

PLANNED LIGHTING PROGRAM FOR SCHOOLS—Edison Electric Institute, New York 17, N. Y.

WATER LEVELS AND ARTESIAN PRESSURE IN OBSERVATION WELLS IN THE UNITED STATES IN 1944—Part 1. Northeastern States. Paper No. 1016. 65c. Part 3. U. S. Geological Survey. For sale by the Northwestern States. Paper No. 1020. Superintendent of Documents, Washington 25, D. C. 40c.

GEOLOGY OF DAM SITES ON THE UPPER TRIBUTARIES OF THE COLUMBIA RIVER IN IDAHO AND MONTANA—Part 3.—By C. E. Erdmann. U. S. Geological Survey Paper

The Whisper that Grew!

by Mr. Friendly

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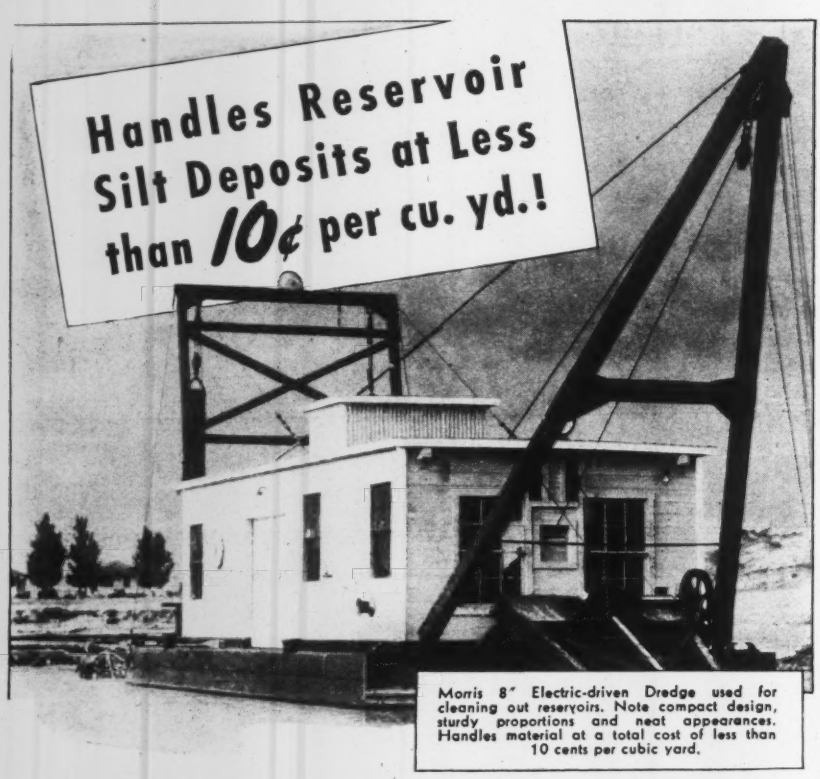

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No. 866-C. Superintendent of Documents, Washington 25, D. C. 50c.

PROCEEDINGS OF THE ANNUAL MEETING OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION—1947—Engineering College Research Council, State University of Iowa, Iowa City, Iowa.

LA INDUSTRIA ARGENTINA DEL CEMENTO PORTLAND—Association de Fabricantes de Cemento Portland, Buenos Aires, Argentina.

PERFORMANCE STANDARDS STRUCTURAL AND INSULATION REQUIREMENTS FOR HOUSES—Housing and Home Finance Agency, Washington 25, D. C.

THEORY OF ELASTICITY FOR THIN CIRCULAR CYLINDRICAL SHELLS—By Sigge Eggwartz, Institution of Structural Engineering, The Royal Institute of Technology, Stockholm, Sweden, Kr. 2.

EVALUATION OF A STEEL-FRAME CONSTRUCTION SYSTEM—Research Study No. 14, John B. Pierce Foundation, Raritan, New Jersey. 50c.

TRAFFIC SURVEY OF ALEXANDRIA METROPOLITAN AREA—Department of Highways, Baton Rouge 4, La.

AN ECONOMIC STUDY OF INTERIOR BLOCK PARKING FACILITIES—Technical Report 5—By C. S. LeCraw. Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

MAKE YOUR TOWN SAFE—National Safety Council Pamphlet No. 133—By H. Yahraes. Public Affairs Committee, Inc., 22 E. 38 St., New York 16. 20c.

DUTIES AND POWERS OF ZONING BOARDS OF ADJUSTMENT IN BERGEN COUNTY—County Planning Board, Hackensack, N. J.

N.M. boosts minimum rate on public works 12%

New Mexico has boosted by about 12 per cent its minimum wage rates paid for public construction. The new minimums are applicable on all public works contracts in the state of $2,000 or more, according to Labor Commissioner Alda E. Joiner.

Joiner said the new rates, with minor exceptions, do not "effect a wage increase," explaining that the new scale merely makes legal the minimum wage rates already prevailing over the state and that most contractors already have been paying them in order to obtain the labor. The new scales replace those set April 10, 1946.

Minimums include: common labor, raised from 75 cents to $1 an hr; journeyman carpenters, $1.50 to $1.75; blacksmiths, $1.25 to $1.62½; brush painters, $1.25 to $1.50; spray painters, $1.50 to $2; plumbers and steam fitters, $1.75 to $2. Plasters' minimum was not changed, and is $1.75 an hr.

No place for a weakling!

No need to tell you that when you tackle a tough job, you need tough equipment.

That's why so many construction engineers rely on Monarch Air Hose for heavy-duty air tool or compressor service where hot oil conditions are especially severe. It saves money by reducing costly work delays caused by air hose failures.

Once you use Monarch, you'll discover why it can "take it" where no weakling could stand up.

You'll find that its tough, nonporous, oil-resisting tube neither swells nor flakes—even under conditions of constant exposure. Its carcass is constructed of multiple braids of tightly twisted cord that provide high burst-resistance . . . help prevent kinking. And special rubber friction between braids assures maximum flexibility and protection against moisture penetration.

Furthermore, its tough, oil-resisting cover is specially compounded to resist abrasion, as well as impact, oil, weather and sun-checking.

Remember, too, that Monarch Air Hose is only one of several types of products developed by Hewitt for the construction industry.

Others include: Ajax Air Hose for moderately severe air tool work, Conservo Air Hose for general air tool service, Water and Water Suction Hose, Steam Hose, Conveyor Belting, etc.

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You can depend on your equipment supply specialist

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INDUSTRIAL HOSE • BELTING • PACKING

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NOW CONVEYCO offers the finest development in automatic weigh batching — an Electronic Controlled Weigh Unit, which can be adapted to any weigh batching equipment. No complicated mechanisms. This Conveyco Unit is designed around standard electrical equipment, using a dial scale with *single indicator* and *one photo electric cell.*

Modernize your old outmoded Batchers, Ready Mix Plants or Asphalt Hot Plants with this new Conveyco Electronic Weight Control Unit. Write for information.

Investigate Conveyco Portable Batch Plants and Portable Bulk Cement Silos — also the Conveyco never-leak Cement Valve for Cement Hoppers and Bulk Cement Silos.

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New York • Chicago • Philadelphia • Los Angeles • San Francisco
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Manufacturers' Activities

INTERNATIONAL HARVESTER CO. has announced the following changes in branch personnel: E. Ingram has been appointed branch manager succeeding C. R. Frobes, who has retired; W. C. Habert has been transferred to Portland, Ore., as assistant manager to replace H. O. Juckeland, who has resigned to enter business for himself; R. E. Dunstan has been appointed assistant manager at Columbus, Ohio, motor truck branch; R. C. Battey, Jr., has been transferred to Minneapolis motor truck branch as assistant manager; Hugh Hanks is assistant manager at Sioux Falls.

THE STATE TRACTOR & EQUIPMENT Co. of Phoenix, Ariz. has been appointed distributor for The Euclid Road Machinery Co. covering the entire state of Arizona with the exception of Navajo, Apache and Mohave counties. Roy Robinson is president; J. H. Tiller is sales manager and W. H. Bridges is office manager.

V. H. Peterson, manager of the railroad division of FAIRBANKS, MORSE & Co., announces the appointment of James G. Graham as sales manager of the division with headquarters at 600 South Michigan Ave., Chicago 5, Ill.

Appointment of JOHN G. CALEY as manager of the national accounts department for the Southern division of Mack Trucks is announced. His headquarters will be in Atlanta.

Opening of a new equipment showroom and service plant at 721 Oakland Park Ave., Columbus, Ohio, is announced by the GIBSON-STEWART CO., distributors of contractors and industrial equipment.

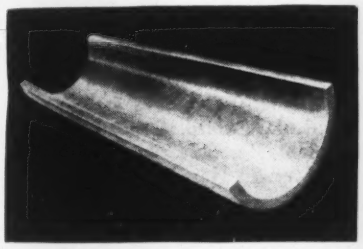
Appointment of eight new dealers and distributors is announced by DAVEY COMPRESSOR CO., Kent, Ohio. New full line distributors: National Equipment Co., Louisville, Ky., M & F Equipment Co., Albuquerque, N. M., C. H. Jones Equipment Co., Salt Lake City, Utah; J. W. Grass Equipment Co., Atlanta, Ga. Named as industrial compressor dealers are Summit Hardware Co., Akron, Ohio, and Portable Service Equipment Co., North Philadelphia, Pa. Warner & Derickson, Inc., Toledo, Ohio, has been appointed to handle Auto-Air (truck-mounted) compressors.

Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

Carrying Capacity

EXAMINATION of the interior wall of Transite* Pressure Pipe will quickly disclose its uniformly smooth surface. This smoothness, imparted during manufacture by forming each length under pressure on a highly polished steel mandrel, accounts for the high flow coefficient of Transite Pressure Pipe—C=140, based on the Williams and Hazen formula.



The unretouched photograph above shows Transite's exceptionally smooth interior surface—imparted by the polished steel mandrel on which the pipe is made.

Moreover, because Transite is made of asbestos and cement, it is inherently and completely immune to tuberculation. This means that the initial high carrying capacity of this pipe remains high in service—a fact which has been confirmed by accurate Pitometer tests.

One important advantage of Transite's maintained high carrying capacity is the assurance of an ample flow of water for both normal and fire-fighting needs in the years to come. Pumping equipment can be operated closer to peak efficiency; pumping costs can be held to a minimum. Taxpayers can receive the benefits of the favorable fire insurance rates which result from a modern, efficient water distribution system of ample capacity.

Accurate Pitometer tests conducted in the field verify Transite's maintained carrying capacity of C-140.

Another advantage—the engineer may design his water system with pipe of minimum diameter, rather than resort to larger pipe than would otherwise be necessary in order to offset the progressive reduction in flow caused by tuberculation. This practice is not necessary when Transite Pressure Pipe is specified.

As indicated by tests, Transite's *maintained* carrying capacity helps provide the abundant fire-flow essential to adequate protection and to favorable fire insurance rates.

And, of course, since tuberculation is not a problem, the costly expense otherwise involved in cleaning and lining of water mains can be eliminated.

A maintained high-carrying capacity is one of many advantages of Transite—the modern asbestos-cement pipe that was engineered to carry water more efficiently and more economically. For further facts, write for Brochure TR-11A. Address Johns-Manville, Box 290, New York 16, New York.

*Transite is a registered Johns-Manville Trade Mark

JOHNS-MANVILLE JM PRODUCTS

BATES • GRATES

fit into every plant picture

If yours is an application like this—with pipes, installations and stairways cutting into the area— BATES • GRATES *will give you neat, safe and strong open steel flooring.*

Here's where BATES • GRATES *win universal approval—where a series of stairways combine with short walkways. Safe and strong, plenty of light and ventilation all the way down.*

YOU can use BATES • GRATES for flooring any area or running any stairways. They serve to advantage in many ways: They are strong, safe, easy to maintain, durable, provide maximum lighting and ventilation.

The simple directness of BATES • GRATES engineering accounts for these advantages. The key is the Hex Cross bar fillet-welded to stout main bars.

For open steel flooring and stair treads in your plant . . . *Get a Bid from BATES*

Track-Air (tractor-mounted units and Davey heavy-duty truck power take-offs, William S. Bolden Co., Charleston, W. Va. will sell and service Davey Air Chief portable and industrial compressors. This firm has branches in Wheeling and Parkersburg.

L. A. WELCH, prominent Peoria business leader, has been appointed executive vice president for the LeTourneau Corp., Peoria, Ill.

INTERNATIONAL HARVESTER Co., motor truck division announces the appointment of C. W. Prestin as sales promotion manager New York sales district, 570 West 42nd St., New York City.

The appointment of HUBERT E. SNYDER as managing director of the Toncan Culvert Manufacturers Association has been announced. The association is composed of manufacturers and engineers who use Toncan iron, a product of Republic Steel Corp., and has recently moved to the Midland Bldg. Cleveland, Ohio.

Announcement has been made by LIMA LOCOMOTIVE WORKS, INC., Lima, Ohio, that the vacancy caused by death of G. L. Lillard, former district manager at Memphis, Tenn., will be filled by Fred L. Maus, who will cover Tennessee, North and South Carolina, Georgia, Florida, Alabama, Louisiana and Arkansas. Mr. R. A. Otterness of Spokane, Wash. has been appointed to succeed Mr. Maus at Dallas as district manager covering Texas, New Mexico, Colorado and Oklahoma.

Addition of two engineers to the staff of the UNIVERSAL CONCRETE PIPE Co., Columbus, Ohio, has been announced: Fred W. Morse and Fred W. Plapp, both of Worthington, Ohio. Mr. Morse is in the production engineering and control department and Mr. Plapp in the product design engineering division.

C. W. Ballard, assistant manager of HERCULES POWDER Co.'s explosives department district office in Pittsburgh, has been appointed manager, succeeding John M. Martin, who has been made assistant general manager of the company's cellulose products department in Wilmington, Del.

THE BARIUM STEEL CORP. has started delivery of 70 specially constructed Giant Electric Whirley Gantry cranes under a $6,500,000 order from the French Government.

JOHN A. ROEBLING'S SONS Co., Trenton, N. J., manufacturers of wire rope

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

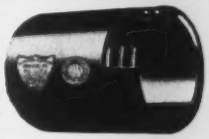
When You Need Suction Hose

You Really Need It!

Because suction hose is not used constantly on most construction jobs, many people figure that the cheapest kind of suction hose is good enough.

But we don't figure that way. We know that suction hose not only must take on-the-job punishment, but also the heavy abuse entailed in moving it from one job to another.

That's why you can be sure of "U. S." hose —from the large, heavy sand suction and discharge hose used in dredging operations right down to the everyday lightweight suction hose. Available at your equipment distributor or the nearest branch of United States Rubber Company.

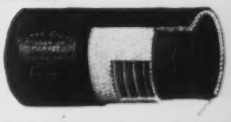


U. S. GIANT SAND SUCTION HOSE.
Toughest abrasion-resistant tube. Powerful fabric and wire reinforcement. Sun and wear resistant cover. Smooth bore. Sizes 4" I. D. and up.

U. S. PEERLESS SUCTION HOSE.
For building construction and trench work. Maximum flexibility without danger of collapse. Smooth bore. 2" to 12" I. D.

U. S. RAINBOW SUCTION HOSE.
Lightweight hose for diaphragm pumps used in sewer and foundation operations. Rough bore. 1½" to 6" I. D. inclusive.

U. S. GIANT CONTRACTORS WATER SUCTION.
Smooth bore, wire-woven carcass abrasive resistant cover. Unusually lightweight. Easily reshaped if crushed or flattened. 1½" to 4" I. D.: Can be used for suction or high pressure discharge service.



U. S. ENGINEERED RUBBER PRODUCTS FOR THE CONTRACTOR

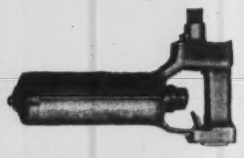
Air, Water, Steam, Suction Hose • Belts • Packings • Tape

SYNTRON

CONSTRUCTION and MAINTENANCE TOOLS

"Portable"

ELECTRIC HAMMERS



—for drilling, cutting, chipping concrete and masonry—scaling old paint and rust.

"Gasoline Hammer"

PAVING BREAKERS

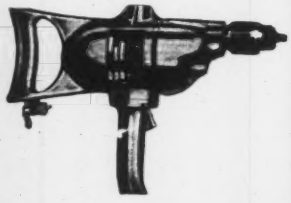
100% Self Contained

Busting Concrete
Digging, Clay, Shale, Hardpan, etc.
Tamping, Backfill
and a host of other jobs

"Portable"

ELECTRIC DRILLS

3/16" to 1" capacity

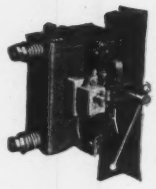


External Concrete Form

VIBRATORS

Setting and compacting concrete in thin wall forms, pipe forms, standards, etc.

The industrial models can be applied to bins, hoppers and chutes to keep material free-flowing.



Save Your Money and Time

on hundreds of "nuisance" jobs

Write for illustrated literature

SYNTRON CO.

328 Lexington Homer City, Pa.

and wire products announces the appointment of H. S. Christie as manager of the Atlanta, Ga. branch office. He replaces C. G. Mullings, recently retired after 45 years of service in the Atlanta territory.

THE COLORADO FUEL AND IRON CORP. announced the appointment of J. S. Eskin as general manager of sales of Realock Fence Division for the corporation and its subsidiary companies. He will be at 361 Delaware Ave., Buffalo 2, N. Y.

PAUL S. PARK has been named manager of the engineering service department of A. M. Byers Co., Pittsburgh, Pa., manufacturers of wrought iron. Besides handling engineering problems dealing with the use of wrought iron pipe and plate in industrial, marine, railroad, refrigeration, construction, petroleum, sewage and waterworks fields, this department has been instrumental in the development of radiant heating and snow melting systems.

HEWITT RUBBER DIVISION, Hewitt-Robins, Inc., has resumed production of its top brand Maltese Cross fire and chemical hose, after being withheld from manufacture during the war because of government restrictions on the use of premium quality materials.

CABL-OX CORP., Chicago, Ill., announces that it has purchased the entire and exclusive rights to the Cabl-Ox wire rope clamp, Cabl-vise and allied wire-rope products, which it will manufacture and merchandise on a much enlarged and accelerated plan.

THE GEO. T. RYAN CO., equipment distributors, Minneapolis, Minn., announces the appointment of Roy H. Smallwood as sales manager of that organization. The company is Minnesota distributor for LaPlant-Choate earth-moving machinery, Jaeger equipment, Galion power graders, Buckeye

On most jobs When Excavating is Necessary

You'll most likely come face to face with one or more Owen buckets, should your travels take you to an excavating job.

The reason why is most simple, for consistent superior bucket performance by Owens is responsible for their widespread use and acceptance.

Bring your equipment catalog files up to date NOW by requesting your copy of the latest Owen Catalog.

The OWEN BUCKET Co.

6010 Breakwater Avenue Cleveland, Ohio

Branches: New York Philadelphia Chicago Berkeley, Cal.

This huge aircraft plant, roofed and sided with "Century" Asbestos Corrugated, will withstand a lifetime of service without maintenance or deterioration.

ASBESTOS IN ACTION

"Century" Asbestos Corrugated is easy to drill and cut on the job.

WHAT OTHER SHEATHING MATERIAL GIVES YOU ALL THESE ADVANTAGES?

If you're planning some new industrial construction, or remodeling, it will pay you to look into the advantages of K&M "Century" Asbestos Corrugated. Compare these features with those of any other roofing and siding material:

1. **FAST, ECONOMICAL CONSTRUCTION**—19 available sheet sizes speed up installation. New "Topside" fasteners eliminate costly scaffolding on roof jobs, as *all* fastening can be done from atop the roof's surface.

2. **STRUCTURAL STRENGTH**—"Century" Asbestos Corrugated withstands severe stresses, such as snow loads, other common conditions.

3. **IMMUNITY** to fire, weather, rust, corrosion, galvanic action. Being made of asbestos and cement, "Century" Corrugated cannot fall victim to these damaging forces.

4. **ATTRACTIVE APPEARANCE**—pleasing light gray color provides attractive, modern appearance . . . banishes that forbidding "gloom" so characteristic of many industrial plants in the past.

5. **FREEDOM FROM MAINTENANCE**—"Century" Asbestos Corrugated never needs painting, is highly resistant to oil, acids, brine, other destructive agents.

•

Truly, here is the material adapted to today's industrial construction needs. You'll find it ideally suited to the job you have in mind. If you'd like to know more about it, just write us—we'll give your inquiries prompt consideration.

Nature made Asbestos
Keasbey & Mattison has made it serve mankind since 1873

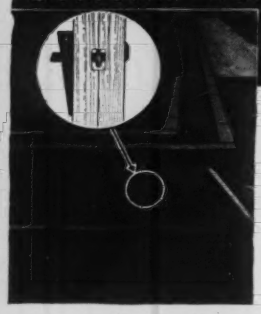
K&M best in asbestos

Reg. U. S. Pat. Off.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

SYMONS CONCRETE FORMS



Your answer to low foundation costs

Here's Why!

Symons Concrete forms save you 50 to 75% of the entire labor of forming. You eliminate eleven costly steps in concrete form construction, and the following materials:

- √ Nails
- √ Lumber for more than one waler
- √ Most of the lumber for bracing
- √ Loss of lumber caused by the splitting action of nails
- √ Spreaders

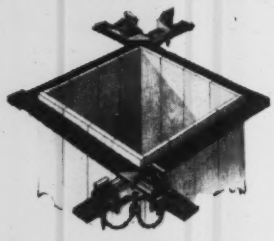
These forms can be built in your own shop . . . saving you freight . . . or you may purchase the forms complete.

Inset shows head on view of tie.

At left is cross section view of tie.

SAFETY SHORES and "Ever-Square" COLUMN CLAMPS

. . . . the builders choice



"EVER-SQUARE" COLUMN CLAMPS . . . with one piece, 90 degree angle bracket which positively squares up column. Adjustable to smallest fraction. No detachable parts. Bars of alloy steel, corner brackets of malleable iron.

ADJUSTABLE SAFETY SHORES . . . Light in weight, easy to adjust, no instructions are needed and they have greater load capacity. The lifting jack lifts like hydraulic. Malleable castings.

Symons Concrete Forms, Safety Shores and Column Clamps can be rented with 90-day purchase option. Paid rentals apply on purchase price. Write today for complete details and prices

SYMONS CLAMP & MFG. Company
4265 W. Diversey Ave.
CHICAGO 39, ILLINOIS

ditchers and shovels, Oliver-Cletrac crawler and industrial tractors as well as other lines of construction materials and equipment. Headquarters are at 171 27th Av., S. E., Minneapolis.

C. B. DAVIDSON has been appointed as Southeastern district manager of construction material sales for General Electric Co. with headquarters in Atlanta.

FELIX W. SWEENEY has been appointed assistant sales manager of Wayne Crane Division of American Steel Dredge Company, Inc. He will conduct sales clinics in the Western territories, while Don L. Douglass, sales manager, will cover Eastern States.

LINK-BELT CO., Chicago, Ill., announces the following changes in sales management personnel: James B. Elliott, divisional sales manager at the company's plant in Minneapolis, Minn., Erwin A. Wendell, divisional sales manager for Caldwell plant products, at Caldwell; T. W. Matchett, district sales manager, Chicago branch, at the Pershing Road plant.

WILHELM-DAVIES CO., INC., North Colony Road, Wallingford, Conn., has been appointed sales agent for the complete line of Lima shovels, cranes and draglines in the state of Connecticut.

COLUMBIA STEEL CO., United States Steel subsidiary, has announced that a cold-reduction mill with a capacity to produce over 300,000 tons of sheets a year will be built by that company in the Los Angeles area. It is hoped that construction of the new mill will be completed by the end of 1949. In addition to cold reduced sheets, the new mill will also be equipped for hot-rolled sheet processing and for sheet galvanizing and coating.

BRIG. GEN. T. M. OSBORNE, Army engineer who directed construction of some of the Southwest's leading military installations early in World War II, and later in the war became commanding general, Ninth Port and South District, Persian Gulf Command, has retired from his Army duties and become associated with Koppers Co., Inc. He will become assistant to the manager of the engineering and construction division's control section.

LENVIK YLVISAKER has been appointed assistant manager and Joseph G. Bradshaw production statistician of the Koppers Co.'s production department.

LONG EXPERIENCE AND EXTENSIVE FACILITIES FOR ENGINEERING AND CONSTRUCTION IN GUNITE

- Lining for tunnels, mines, steel bins and hoppers
- Lining old, tuberculated, or clogged water mains to renew life and increase flow capacity
- Rehabilitation of dams, docks, bridges and walls
- Restoration of spalled, weathered or damaged concrete buildings
- Refractory linings for furnaces and stacks

Our Engineers are available for consultation

NATIONAL GUNITE CORPORATION

420 Lexington Avenue, New York 17, N.Y.
101 West Dedham Street, Boston 18, Mass.
418 Evans Building, Washington 5, D.C.

DEPENDABLE ELECTRIC POWER

2000-Watt Generating Set

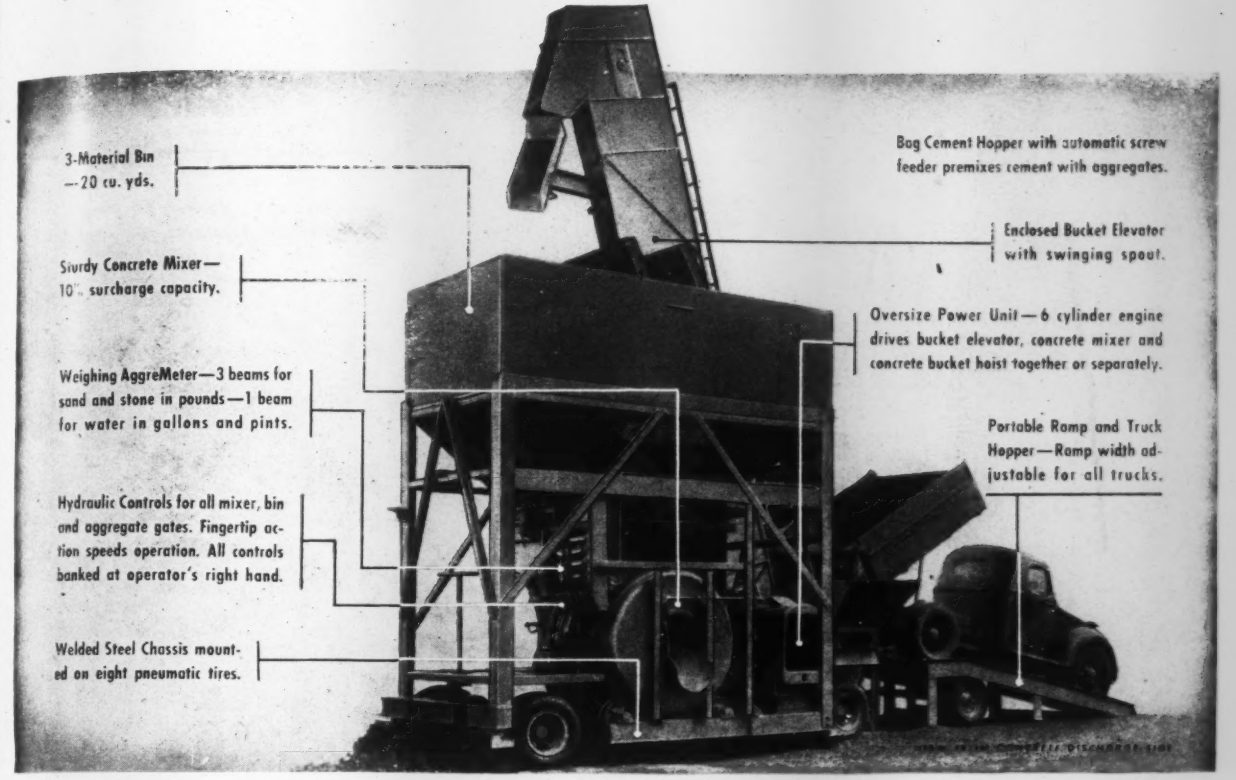
FAIRBANKS-MORSE GENERATING SETS

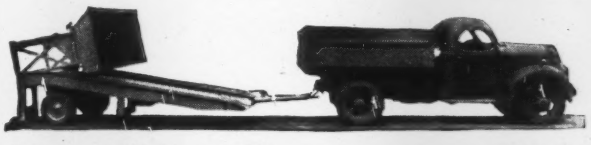
PERFORMANCE-PROVED to meet your requirements. Capacities, 350 to 35,000 watts. Compact, single-unit design, sturdy construction. Give unfailing service even under continuous, heavy-duty operation. A.C. and D.C. types, remote and automatic start. Send coupon for FREE literature today!

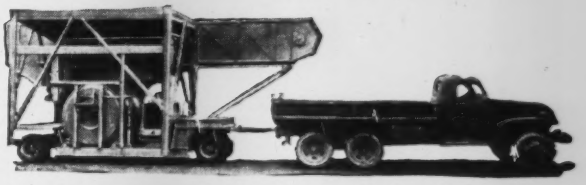
Fairbanks-Morse

A name worth remembering

FAIRBANKS, MORSE & CO., Dept. K-11
Chicago 5, Illinois
Please send free literature on Fairbanks-Morse Generating Sets.
Name .....
Address .....
City ..... *State* .....


3-Material Bin —20 cu. yds.
Sturdy Concrete Mixer— 10 surcharge capacity.
Weighing AggreMeter—3 beams for sand and stone in pounds—1 beam for water in gallons and pints.
Hydraulic Controls for all mixer, bin and aggregate gates. Fingertip action speeds operation. All controls banked at operator's right hand.
Welded Steel Chassis mounted on eight pneumatic tires.
Bag Cement Hopper with automatic screw feeder premixes cement with aggregates.
Enclosed Bucket Elevator with swinging spout.
Oversize Power Unit—6 cylinder engine drives bucket elevator, concrete mixer and concrete bucket hoist together or separately.
Portable Ramp and Truck Hopper—Ramp width adjustable for all trucks.





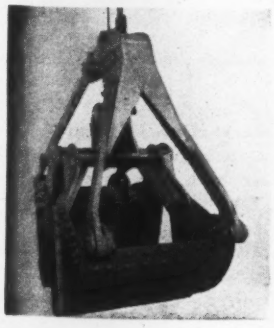
Portable Concrete Plant *Moves from Job to Job*

BE prepared to make specifications concrete at 30 or 40 yards per hour wherever your jobs take you. The complete Strayer Portable Plant includes 20 yard Aggregate storage loaded by bucket elevator. A 4—beam AggreMeter weighs sand, aggregates and water. Bag Cement is premixed with aggregates before entering Concrete Mixer. Finger-touch hydraulic controls of all operations are banked at operator's right hand. New features make this original plant easier and faster to operate and to make ready for setup or moving. Write for new booklet describing the ¾ and 1 yd. plants and the new auxiliary concrete bucket hoist.

ERIE STEEL CONSTRUCTION COMPANY

1711 GEIST ROAD, ERIE, PA.

BUCKETS FOR THE JOB • ALSO AGGREMETERS



There's more payload less dead weight and greater strength in the new line of Erie Clamshells. The 2-rope Rehandler illustrated is available from stock in the correct size for your crane and job. Erie builds the most complete line of buckets offered by any manufacturer — Write for complete data on the bucket for your work.

ERIE GA PORTABLE AGGREMETER PLANTS standardized in 54- 78 or 102 Ton capacities use a specially designed 3-material weighing AggreMeter in 1, 1¼, 1½ and 2 cu. yard capacities. We are producing these plants in quantity and can make good delivery. Booklet GA-1 tells its story—Outline your requirements.

Haunted by supply problems?

Solve 'em by Air Express!

Don't let low stocks or distant supply points scare you! With Air Express cutting delivery time down to a matter of hours, you can get what's needed from anywhere in a rush. Just remember to specify Air Express. Your shipment flies to you at speeds up to 5 miles a minute. Air Express goes on all flights of all Scheduled Airlines — that means the fastest possible service.

Use Air Express regularly. You'll find there's real profit for you in such speedy service. And rates are *low*. Frequent flights to and from points overseas can simplify your foreign shipping problems, too. Investigate.

Specify Air Express-it's Good Business

- Low rates—special pick-up and delivery in principal U.S. towns and cities at no extra cost. • Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.
- Direct air service to and from scores of foreign countries.

Just phone your local Air Express Division, Railway Express Agency, for fast shipping action . . . Write today for Schedule of Domestic and International Rates. Address Air Express, 230 Park Ave., New York 17. Or ask for it at any Airline or Railway Express Office. Air Express Division, Railway Express Agency, representing the Scheduled Airlines of the United States.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Fastest delivery — at low rates

Machine parts (75 lbs.) in Chicago were needed by a bottling works in Dallas *fast*. Picked up 10 AM the 6th, delivered same day at 5:05 PM, 795 miles, Air Express charge only **$18.42**. Other weights, any distance, similarly inexpensive and *fast*.

Manufacturers' Publications

Radiant Panel Heating — (40-p. bulletin) Contains non-technical discussion of radiant panel heating designed to furnish architects, engineers and heating contractors with sufficient background to compare this method with other types of heating systems.—*Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.*

Flow Meters—(8-p. bulletin) Announces complete line of corrosive service flow meters, describing instruments made of various corrosion resistant materials, such as porcelain, hard lead, glass, hard rubber, etc.—*Fischer & Porter Co., Hatboro, Pa.*

Distance Measurement—(4-p. leaflet) Describes new Minerva Curvimeter for measuring distances on blueprint or plan.—*Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y.*

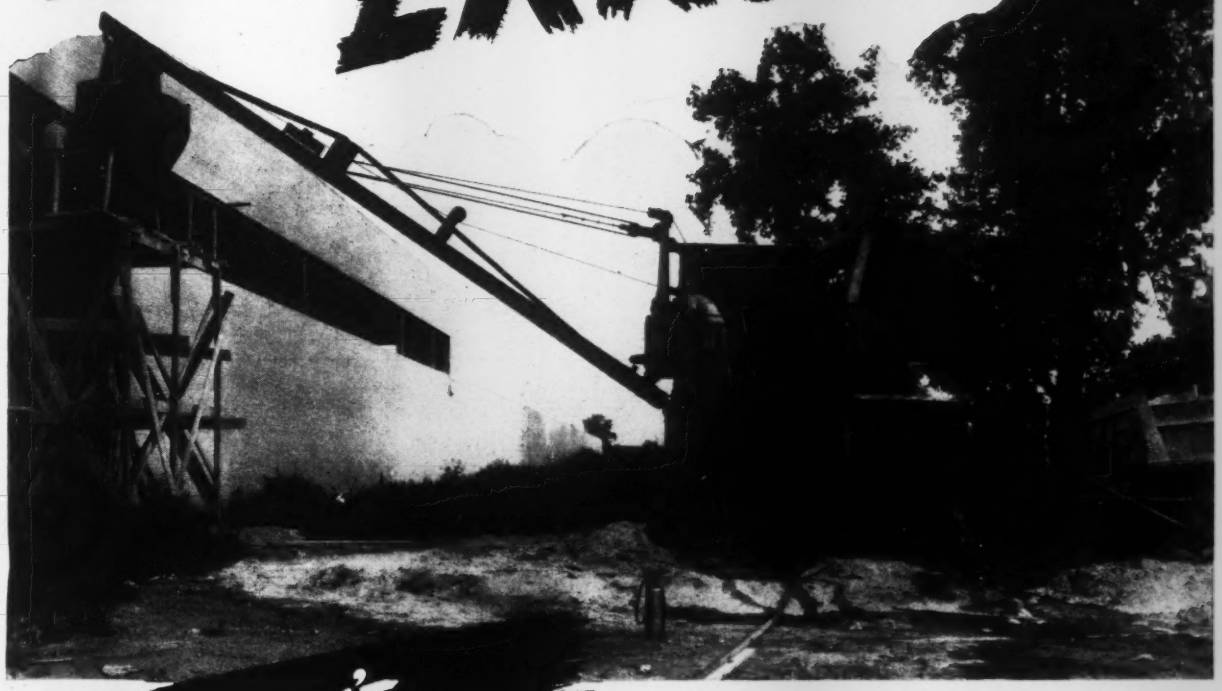
Nickel Alloy—(36-p. booklet) Gives detailed information on physical and mechanical properties of Ni-Resist. Performance under wide variety of industrial conditions involving corrosion, heat and wear is described. Corrosion data for 400 corrosive media are presented in tabular form.—*International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.*

Angling Blade Bulldozer — (8-p. booklet) Furnishes basic specifications and production features of new cable-controlled angling blade bulldozers, Nos. 8A and 7A. It outlines structural advantages and illustrates, with model and cutaway views, blade C-frame, brace, sheave, and push cup construction and angling, tilting and lifting adjustments possible. — *Caterpillar Tractor Co., Peoria 8, Ill.*

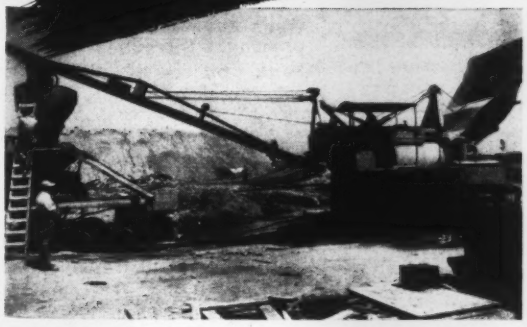
Rubber Packing—(4-p. folder) Outlines advantages of use of Flexo-Pac, pioneer rubber packing to be used in place of jute or hemp for yarning bell and spigot joints on cast iron pipe.—*Rice-Chadwick Rubber Co., Killbuck, Ohio.*

Stationary Diesel Engines—(28-p. bulletin) Describes and illustrates how diesels are built. It carries 46 photographs, 8 performance charts, standard and special equipment tables, and 5 dimensional blueprints, including foundation sizes and amount of concrete required.—*Superior Engine Divi-*

DID YOU SEE THAT ERROR?



DON'T BELIEVE IT!



MultiFoote 34-E Duo Mix (Dual Drum) Paver with elevating boom loading to a Pumpcrete.

MULTIFOOTE ELEVATING BOOMS CLEAR 20 FT.!

A recent Foote Company ad got through with a typographical error saying that the MultiFoote elevated boom would clear 8½ ft. It isn't so! MultiFoote standard elevating booms will clear 18½ to 20 ft. and there are MultiFoote elevating booms in service, of special design, that will clear much more.

- 18½ to 20 ft. clearance.
- The only elevating boom proved in years of service.
- Bucket is adjustable to boom angles.
- All bucket operating mechanism is outside bucket.

Here is the elevated boom you need, a boom with real field experience of several years behind it. Available on 27-E Pavers, 34-E Single Drum Pavers and the 34-E Duo Mix—the big, fast MultiFoote Dual Drum Paver. Ask our sales agents for details.

THE FOOTE COMPANY, INC.
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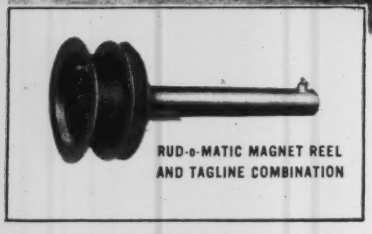

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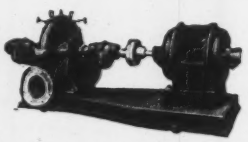

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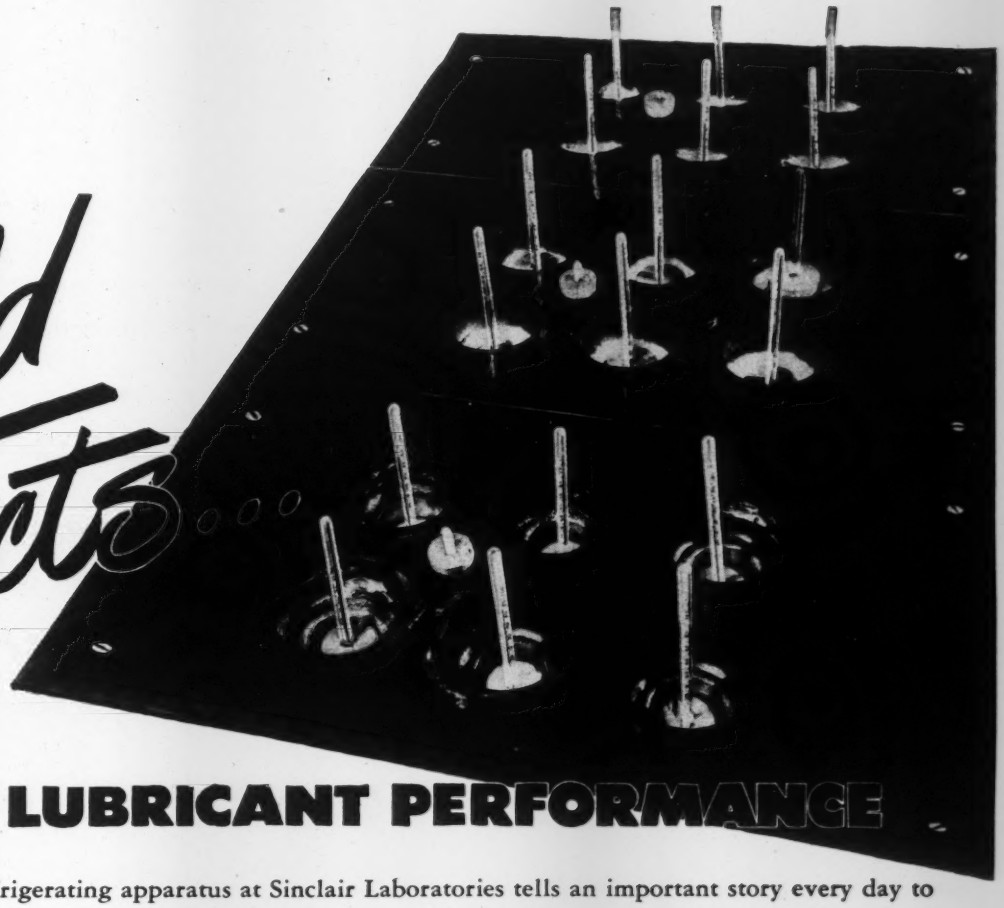

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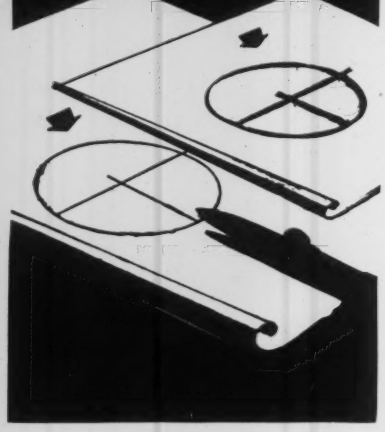

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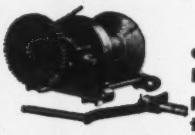

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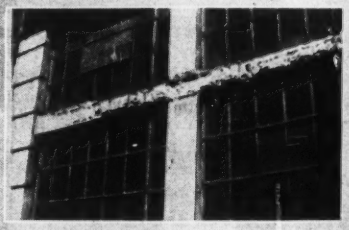

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